AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

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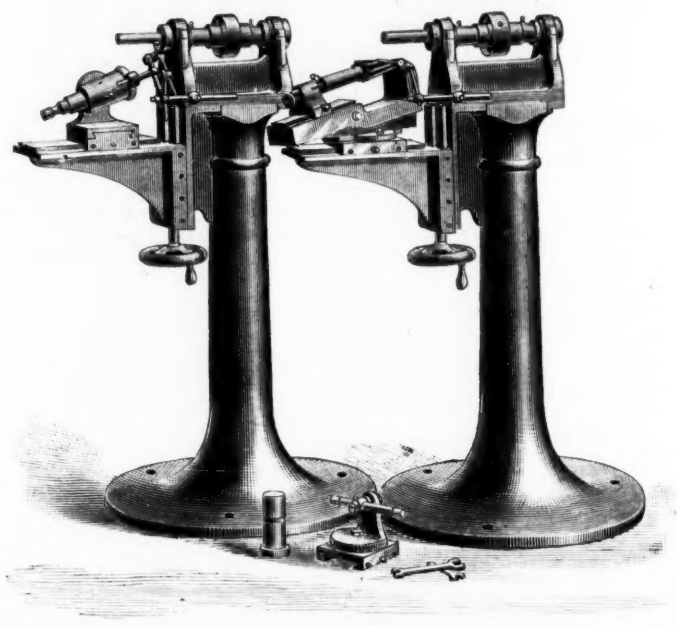
ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

New Machine Tools by the Pratt & Whitney Company.

The cutter grinder shown is furnished with three complete fixtures for holding milling cutters, and shell or solid reamers, of either cylindrical or conical form, and having either straight, beveled or spiral teeth. The several fixtures are fitted to slide on a platen which is adjustable, vertically, by means of a screw and hand wheel, to suit all ordinary sizes of cutters and reamers. One of these fixtures is a pair of reamer-holding centers, taking solid reamers up to four inches in diameter and thirteen inches long, for grinding tapers up to four inches to the foot. The guide rests against the tooth which is being ground, gauging the work perfectly, even though the teeth are irregularly spaced. The spindle, of steel, running in genuine babbitt boxes, has a cone with two grades, and is adapted to carry either small grindstones or emery-wheels. The countershaft has 6x2¼ inch tight and loose pulleys, and should make 480 revolutions per minute. Weight of machine, including countershaft, about 450 pounds.



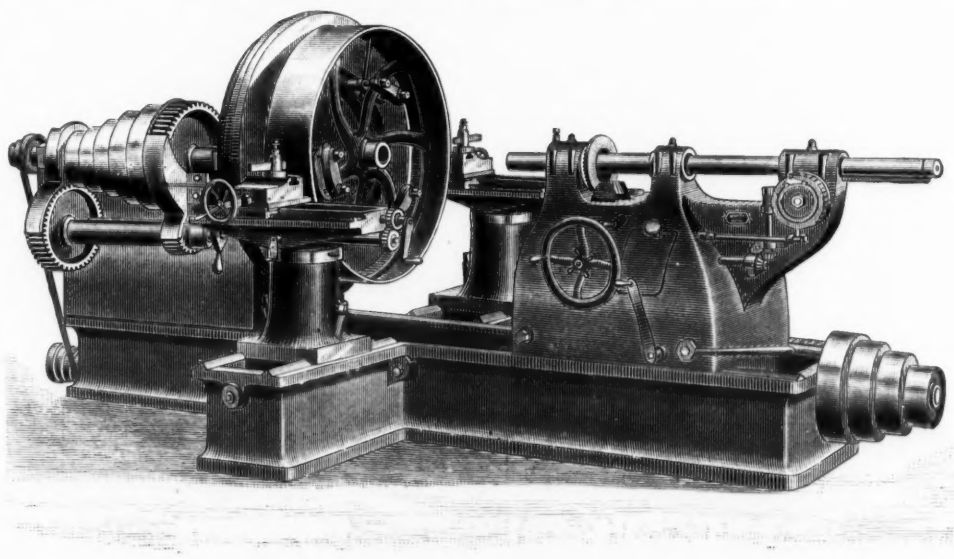
CUTTER GRINDER.

The pulley lathe swings fifty inches over bed, but can be made to swing sixty inches. It has a range of speeds suitable for turning sixteen to forty-eight inches diameter, and will turn the face of pulleys straight, crowning, or of any desired shape from a former. It can be made with two tool-rests, one in front and one in the rear, so that turning and finishing can be done with one operation. The tool-rests have self-acting feed of twenty-two inches in all directions. The foot-block is fitted with revolving spindle and independent driving gear, with suitable boring speeds, so that the machine can turn and bore simultaneously. The foot-block is moved along the bed by rack and pinion, and can be secured at any point. The bed is eleven feet six inches long, and weighs 14,000 pounds.

For squaring up columns, the ways for head stock may be lengthened, and provision made for moving head and securing it at any point on them. A tool-holder, with self-acting feed, for facing hub is furnished when desired.

Speed of countershaft for head, eighteen by five-inch tight and loose pulleys, 140 revolutions per minute.

Speed of countershaft for foot-block, sixteen by four and a-half-inch tight and loose pulleys, 120 revolutions per minute.



PULLEY LATHE.

Inquiries on Making Steel Ordnance.

The committee appointed by the United States Senate to inquire into the facilities of our private manufacturing establishments for producing heavy steel ordnance has got to work. They have sent out circulars to manufacturers which call for information on the leading points. The answers are required to bring out the capacity of our principal iron works, and the quality of steel they are able to produce, to what tests it has been subjected, and by whom the tests were made. The report of the Gun Foundry Board, which recently inquired into the system of making steel ordnance in Europe is submitted to our steel makers, and they are requested to state whether they have any, and which of the machine-tools and other facilities for making guns therein mentioned; also whether they could make the machines described, and at what cost. They are asked to give their experience in the use of steam-hammers and hydraulic forging presses, and their impressions of the relative value of the two systems in doing heavy iron or steel work; also as to the merits of compressing the liquid metal in the mould immediately after it has been cast by means of the hydraulic press.

The committee has held one meeting in the Fifth Avenue Hotel, New York. They now intend visiting the leading iron works and inspecting the processes they wish to learn something about. So far as building the special tools needed to manufacture modern steel ordnance is concerned we can inform the committee that the steel makers are not the proper parties to do that work. In Europe the lines of specialties in doing machine work are not so closely drawn as they are in this country, and it is nothing uncommon there for metallurgical establishments to have a side mechanical department where their tools are made, and skill and proper facilities are provided to get the work done properly. In this country, however, first class establishments are devoted entirely to the line they make their specialty, and works that produce good steel ingots do not trouble themselves with machine making. That is left to first-class machine-making works, which are numerous and perfectly competent to produce in the best style any machine ever devised for industrial purposes. To good machine tool makers the Senate Committee had then better apply for information, if they wish to learn accurately the cost of any special machine that the country may need to employ in making steel ordnance.

Steam boilers (*Adams*)—working pressure, if under periodical inspection = ⅛ ultimate strength, if not under independent inspection ⅙ do.

An Improved Injector.

Mr. Meehan, superintendent of the motive power and machinery of the Cincinnati, New Orleans & Texas Railroad, is using an injector invented by Frank C. Smith, which contains several novel features. The leading aim in designing the injector has been to make an instrument capable of a wide feed range, and the end has been so successfully carried out that this injector can feed a maximum stream of 3,600 gallons an hour, or a minimum of 200 gallons an hour. This varied feed range is better than anything that can be done with the best locomotive pump.

Steam Boilers.

BY GEORGE MARSHALL.

A CHAPTER DEVOTED EXCLUSIVELY TO THE INTERESTS OF STEAM USERS.

Information and advice for the benefit of steam users, to guide them in their purchase of a steam boiler, has from time to time been given through the columns of the AMERICAN MACHINIST, and while some of the advice may have fallen on stony ground, it is reasonable to suppose that more may have fallen on good ground. On the supposition that a repetition of advice on the subject of boiler purchase and construction may be objectionable—although the subject is not exhausted, or, in fact, half ventilated—I would ask the attention of the steam user to a consideration of the fact that from the moment a boiler is put in use until its condemnation, it is constantly depreciating in value and strength, and is becoming more and more, not alone an object of weakness, but an element of danger. As the newspapers from time to time contain full accounts of disasters caused by boiler explosions, the writer need not be considered an alarmist if, in his feeble way, he points out as he understands them the causes and preventives of boiler explosions.

Boilers explode only from over-pressure. There is no mystery about it. The theories of powerful gases generated or caused by the absence of air; the power and danger of a "wedge" formed from steam generation or surface coating of water, and many other ideas of this kind to envelop the causes of boiler explosions, all have their believers; but it is not this class of people for whom this article is written, but for those only who look for a natural solution of those disasters, the effects of which have carried grief into so many homes and financial disaster to many whose entire capital was invested in their boiler, engine, and machinery—the savings of a lifetime destroyed in a moment. By over-pressure it must not be understood that a pressure is meant so far removed from the average working pressure of the boiler, as it is the pressure employed over and above what the boiler was capable of carrying at the time of the disaster. This may be caused by improper construction on the part of the builder, improper method of repairing when repairs were resorted to, or a deterioration in

the strength of the structure by corrosion, incrustation, oxidation, channeling, or other causes of this nature, which due precaution and proper inspection by competent, educated inspectors would have entirely averted, as such causes as already enumerated are possible of detection.

Improper construction is not as fully understood as it should be, nor will it be until competent inspectors are appointed by the purchaser, State or county officials, as the competition is so great between manufacturers, as a rule, that dishonest practices in building are almost forced upon the builder, from the fact that steam users generally look more to the first cost of their plant than they do to its proper construction.

Ignorance on the part of journeymen boiler-makers when sent to make needed repairs, and inattention on the part of foremen and employes to the actual requirements of the case, can and do add to the risk of explosion, from the fact that unusual rigidity in certain parts of the boiler accelerates the disaster by throwing unusual strain on a weak part. For this reason only the very best talent should be employed in repairing, as that is of equal importance to the strength of the original structure. But, unfortunately, it seldom happens that intelligent, educated workmen are employed on this class of work. In the majority of cases those employed for this have risen from helpers, an account of their ability to please customers by their hard work and the nominal saving of expense by such hard labor. They do not as a rule understand why a patch, small or large, sufficient in itself to remove the defective part, is not of equal strength to any other part of the boiler; neither do they understand anything about the expansion and contraction taking place, and for this cause, although good workmen as workmen, yet in other respects they are entirely incompetent to perform the duties assigned to them.

It should be a rule adopted by all steam users to insist on the ideas of the inspector regarding boiler repairs being rigidly enforced when such boilers are under competent insurance and inspection, and where there is no such inspection, insist on the shop foreman inspecting the damage and suggesting the proper remedy. That this is not done is owing to the fact that the foreman's time and expenses are usually charged, and charged heavily, when on such service, and rather than pay for such expenses the owners virtually assume all the risk of damage from the ignorant, incompetent workman's lack of knowledge and judgment.

A deterioration in strength may occur from the incrustation so generally noticed in the majority of boilers, concealing from the uneducated observer's eye the corrosion frequently taking place underneath, it being well known that pitting, as it is commonly called, is more frequently met with on scale-covered surfaces than where no scale has formed.

The use of a surface blow is found effective in removing a part of the precipitation from foul waters. It can, however, only be effective *when used*. In many cases such things are ornamental, never being used after their introduction. The impurities in water consist mostly of carbonate of lime, sulphate of lime, and carbonate of magnesia. Carbonate of lime is held in solution by an excess of carbonic acid, and is in this case present as a bicarbonate. On the application of heat to generate steam, the carbonic acid is dispelled and carbonate precipitated. Sulphate of lime, chemically composed of the same elements as plaster of Paris, is also precipitated by heat, and is present in nearly all waters used for steam, or, in fact, for domestic purposes. Carbonate of magnesia is generally found in smaller quantities than either of the other ingredients, but in proportion to quantity is just as injurious as the others. When these salts are allowed to remain undisturbed, increased consumption of fuel is the result, and the metal of which the boiler is composed is seriously—in some cases dangerously—burned. Economy, if not safety, would suggest their removal by the person in care of the boiler, but in many cases this will not be done thoroughly, if at all, unless the owner in person gives his attention to the matter.

The expansion and contraction taking place in a boiler often cause fractures, at first imperceptible, in time becoming dangerous. Too often these pass unnoticed, the supposition being that they are old fire cracks; but when carefully watched, they can be seen to increase from time to time. Oxidation takes place, as already stated, under the scale, and, as when the latter is allowed to become hard it is almost impossible to effectually remove it, the former is imperceptible to the ordinary observer. A thorough system of cleaning should in all cases be strictly maintained, and, where the common horizontal tubular boiler is used, the tubes should be removed as often as once in three years, the shell and tubes thoroughly cleaned, and the latter pieced out and returned to the boiler. It is not necessary to purchase new tubes in every case, as with proper care in this way the life and durability of the tube can be indefinitely prolonged, and the economy in fuel will, in most cases, pay for the expense of removing, cleaning and piecing the tubes, the expense of which, including their return to the boiler, should not be more than one dollar and a half for each tube.

In addition to the internal cleaning and removal of scale, attention should be carefully given to the cleaning of the outside of boiler, as seemingly slight leaks and accumulation of sediment frequently cover an alarming oxidation. All accumulations should be removed at once, this referring to soot as well as to the sediment, and the back end of boiler should be as carefully examined as the front, occasionally oiled and the packing in hand-hole plate renewed.

In my experience as a practical boiler-maker, I have found a much larger percentage of boilers injured in the back than in the front heads, and this injury has been caused by neglect in attending to seemingly unimportant matters, chief of which is the leaky condition of back hand-hole plate, which from neglect has caused a wasting of the metal in head around the plate. Leaky tubes in the back end are often passed unnoticed, but these should receive proper and prompt attention when detected, as the corrosion from these has in many cases compelled the removal of entire back head.

The braces in boiler corrode in many cases where the corrosion is visible on the shell, and these should be replaced when wasted away. Internal cleaning is often resorted to in a very ineffectual manner by the engineer or fireman in charge. Internal inspection, not being understood in the majority of cases, is seldom, if ever, indulged in by the engineer. For this reason, where there are no periodical visits from competent inspectors, an examination, internal and external, by a competent person, should be occasionally resorted to.

The area of safety valves, in proportion to horse-power of a boiler, should be ample, and, in addition to area, it should be daily allowed to blow off steam to insure its utility in relieving the pressure. No surplus weights should in any case be allowed on the lever, and, where a boiler is insufficient to do its work without increasing the usual pressure of steam, the latter should never be done until the boiler has been carefully examined to ascertain if capable of carrying the extra load. The use of two safety valves on each boiler is recommended, one of which should be of the lock-up pattern, secured beyond tampering by incompetent, reckless persons.

The steam gauge should also be occasionally tested to determine its accuracy, and never should be entirely depended on to indicate the pressure. The safety valve, as its name indicates, should be the standard of safety, and, no matter of what material, it should be, as already stated, raised daily to insure its perfect working.

Glass gauges should never be entirely depended on to determine the quantity of water in the boiler, as the small openings in the usual connections are frequently clogged, and, while the glass may indicate the usual allowance, an examination of the gauge-cocks would show an insufficient supply.

The blow-off should also receive careful attention; and the "plug," where a cock is used, should be occasionally oiled, and always, when used, turned around once or twice to insure its being tight. The handle of such a plug should never be left on the cock, it being a temptation to tamper with by occasional visitors.

"Eternal vigilance" is the price of safety as well as liberty, and, if the steam user is vigilant in attention to his boiler, explosion will never happen. There are other suggestions on this subject which will be further noticed, but these, if closely attended to, may avert a threatened and serious danger.

Our enterprising and newsy contemporary, the *Southern Industrial Record*, is eloquently advocating the encouragement of Southern manufacturing interests, and the way it draws the attention of capitalists to Southern enterprises worthy of development cannot fail to prove beneficial to the section with which the paper is so closely identified.

While railroad building is almost entirely suspended in the East, and is prostrated in the Western States, indications show that the Southern States are bestirring themselves very actively to secure increased railroad mileage. Every town of any consequence in the South has some railroad project on hand, and the most prosperous and rising cities are agitated by numerous schemes for throwing out steel arteries to bring business to their doors. The enterprising city of Chattanooga has no less than six new railroad projects on hand, and the friends of the city's progress feel confident that most of the projects will soon become realities.

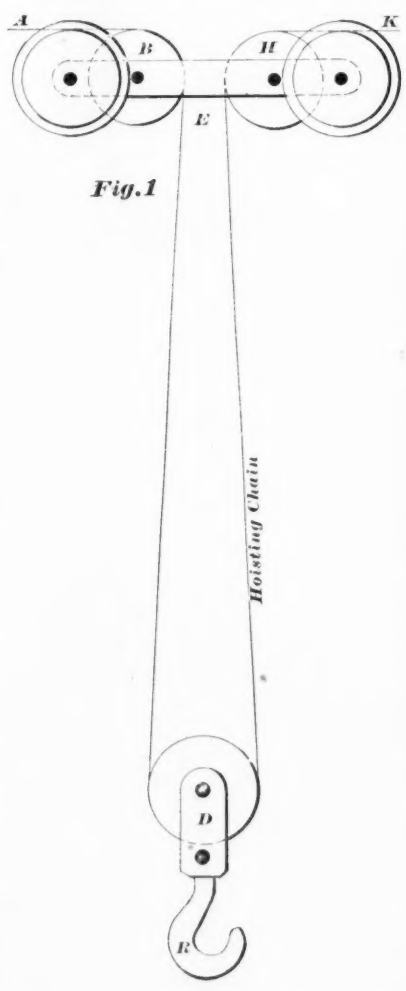


Fig. 1

Elevator Accidents.

The recent fall of an Otis elevator in New York City, which was provided with a safety catch, again draws attention to the uniform inefficiency of devices that are not in regular use. It may be satisfying to the timidity of people using elevators to know that the cage which hoists them to giddy heights is provided with an automatic safety catch, but we believe that the personal safety of those using elevators will be promoted by a system of rigid inspection of the machinery used. The accident referred to was caused by a grossly careless method of fastening the rope to the elevator, which would not have been passed as safe by any inspector interested in preventing accidents. The assertion that an elevator is guarded by a safety catch has a tendency to draw public opinion away from the inherent danger of that means of lifting people in buildings. The work can be done with perfect safety if the elevator is properly constructed and kept in good order, but private vigilance cannot be depended upon to enforce these conditions.

Foundry Cranes.

BY THOMAS D. WEST.

SECOND PAPER.

The Griffith & Wedge power crane shown on next page is used in the foundry of the Niles Tool Works, Hamilton, Ohio. Several cranes stand in a row, and are all worked by one line of overhead shafting, to which power is transmitted by belt. The top gudgeon *A*, being hollow, admits of the shaft *B* passing through it, and being engaged by the miter wheels at *S*, the shaft *R* revolves the driving friction pulley *Y*. To throw the crane into power-hoisting gear, the lever *D* is pulled, which presses the friction drum against the friction pulleys, *F* and *Y*.

To throw the crane into hand-hoisting gear, the shaft *H* and gear *V* slide out, thereby engaging the clutches at *X*. The pinion *Z*, also gear *M*, is keyed to the sleeve; this sleeve, of course, revolves upon the shaft *H*. When driving the crane by power, the gear *V*, which is keyed to shaft *H*, being, as shown, engaged with gear *G*, drives the pinion *L*, which then transmits power to gear *M*, thereby revolving the sleeve and pinion *Z*. The gears, *L* and *G*, being keyed to the brake shaft, make the brake operative, whether worked by hand or by power.

These cranes have a platform at the rear; so the operator revolves with the crane. This also places him high enough to handily reach all the levers. The frame is made of pine.

One special feature is that of the carriage. It is not only a good carriage, but a short one. Many cranes lose nearly half of their working floor area through having a long carriage. There is little sense in building a crane in which the length of jib cannot be more than half utilized. One should remember that the floor room located within the area of the crane jib should be such as could be used for crane work.

Some may think that the sheaves, shown in the plan of carriage, could be made smaller in diameter, and thereby allow of a still shorter carriage. This could, of course, be done, but the 18-inch sheaves, as shown, are advantageous in two respects—first, they are easy upon chains; second, they prevent twisting of the chain when revolving the crane hook with a load suspended from it.

Many use a style of carriage similar to that shown in annexed cut, Fig. 1.

Here the sheaves, *B*, *H*, which the chain or rope, *A K*, passes over, are upon two axles. The carriage of the crane made by Messrs. Griffith & Wedge has sheaves which answer the same purpose as *B*, *H*, Fig. 1, upon one axle. With this style of carriage (Fig. 1) one can often see the hoisting chain hanging out of parallel, as shown. Bringing the chains close together, as at *E*, is often done in this style of carriage for the purpose of making a short carriage. When the hoisting chain in single plys, as here seen, is contracted out of parallel, as at *E*, there is more or less trouble caused when turning the hook *R*. I have often been obliged to lower down and take part of the weight off the crane before I could turn the hook without twisting the chains. Such bother as this is very annoying, besides causing loss of time. I think it is evident that a shorter carriage can be practically worked, made after the style of the Griffith & Wedge carriage, than the one shown in Fig. 1.

Another point which would be well to notice is that of the moving or racking of the carriages. There are many devices for this purpose. With chains there is often much

annoyance, caused through their stretching; and again the chain will be so situated as not to move the carriage steadily. I see by the Griffith & Wedge design the carriage is made, as far as practicable, to overcome these evils. It is hardly to be believed that a chain will stretch as much as it does. I have often been obliged to cut out from one to two feet in rack chains during the first week or so they were used. Many carriages are made with no provisions for taking up any slack. As will be seen at *W*, a simple arrangement for this purpose is provided. Having a slack rack chain often causes much bother, and, where there is no provision for taking it up, it has to be often taken down and cut off, involving much labor.

As will be seen in the plan of carriage, the two sheave wheels are carried to one side of the carriage, in order to allow the hooks, *W* and *C*, to which the rack chain is hitched, to have a pull as near to the center of carriage as is practical. Many carriages are moved by a rack chain upon each of their sides. Again, others will have only one at the extreme outside or in the center. The thing to be sought for, in moving a carriage, is that it shall move along steadily, and have no more friction upon one side of jib than upon the other. The best way to accomplish this is to pull with one chain as near the center of carriage as possible. To pull with two chains would be better were it possible to have them always pull even and alike. This, I think, it is safe to say, is seldom done, even with the flat link chain, which is the best to adopt for that purpose. Where there are two common link chains, one will often see first one and then the other pulling, every change causing a jerk. Were the links of chains all of an *exact* length, and if they would not stretch, then with a true pitch chain sheave they could be depended upon to pull alike.

The blocks of cranes often cause us moulders trouble. They are frequently made so light that it requires the hanging on of weight to pull them down. Again, they will be made without any guard, as shown at *D*, Fig. 1. With such blocks trouble is often caused by their getting out of the sheave grooves. As seen in the blocks of the Griffith & Wedge crane, there is not only a guard, but the blocks are heavy enough to pull the chain down.

It is not necessary that a large sheave be used in order to make weight. Should a small sheave be used, the cheeks of the blocks could readily be made heavy enough to aid the weight of sheave in pulling down the chain.

There is not quite the objection to the chains hanging out of parallel, caused through small lower blocks, that is stated above with reference to the chains narrowing up at the upper or carriage blocks. However, when practicable, it looks and works better to have the lower sheaves large enough to cause the chains to hang parallel.

Mr. Harris Tabor, the well-known indicator inventor, has recently patented an improved cylinder head for steam engines. It consists substantially of a cylinder head and relief plate, the strength of which is less than that of the head, the object to be gained by the invention being the saving of heads from damage by over-pressure or concussion.

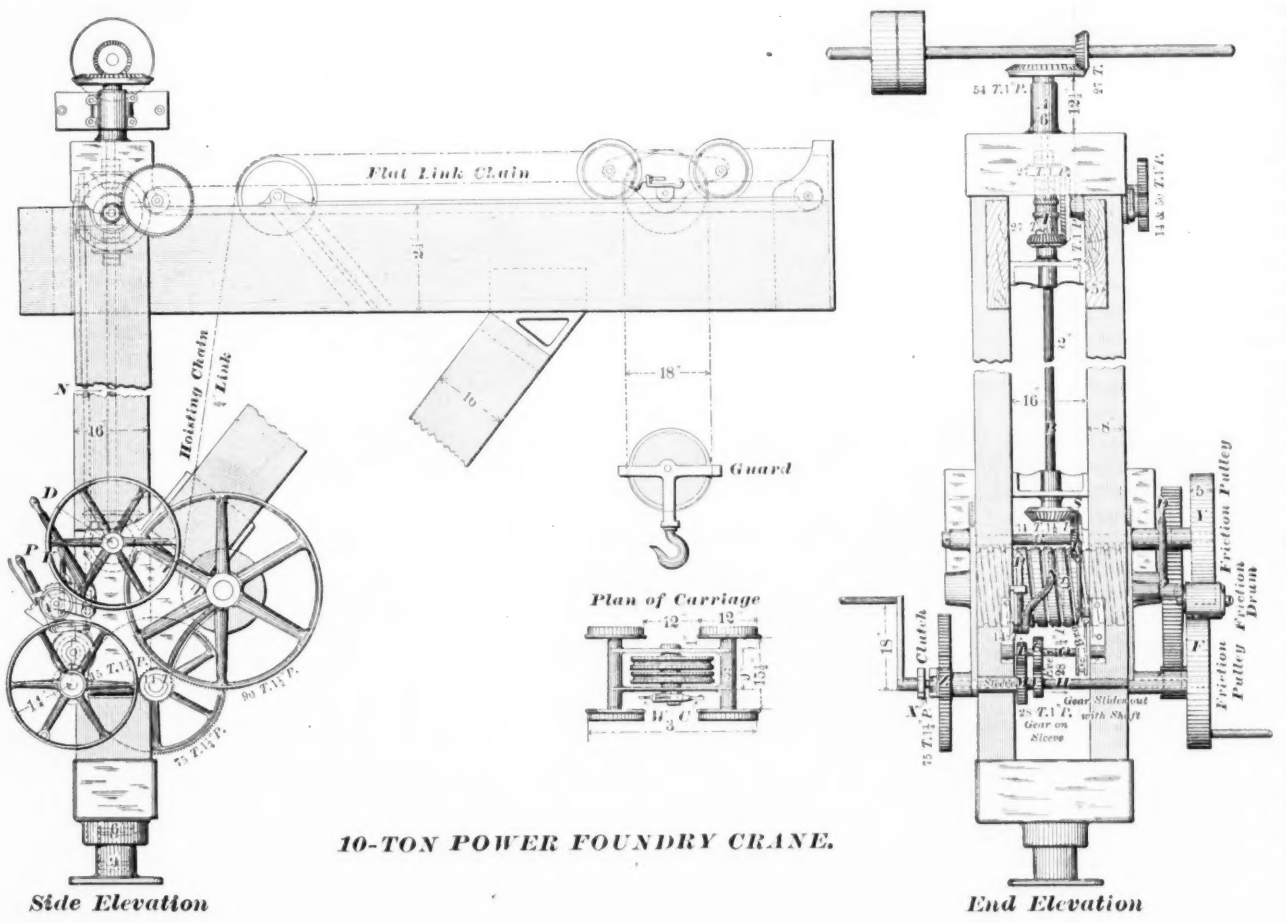
In certain English technical papers we hear a good deal said about the splendid success of Webb's compound locomotives, but the success seems to resemble the crowing of the cock which is supreme on its own manure heap. An important feature of the economical operation of the Webb locomotive comes from the same source that pitted the Webb chain brake against the Westinghouse automatic, and kept the latter brake off the London and North-Western Railway. That was Mr. Webb's strong personality, which insists that the progeny of his brain must be successful. One of his compound locomotives was sent to run on the South-Western Railway some time ago, and its performance was going to effect a revolution in the motive-power of that railway, but we learn that the trial has passed, and the manager of the South-Western is satisfied with his locomotives of the ordinary pattern.

Treatment of American Workmen in Mexico.

A discreditable prejudice against all foreigners will have to be rooted out, and the ordinary method of administering injustice in the courts will have to be changed before Mexico becomes a pleasant country for American workmen or business men to reside in. A strike was nearly made among the train men of the Mexican Central Railroad a short time ago, owing to the numerous arrests of railroad men that had been made by petty village officers without any just cause, and the supreme attitude of the railroad authorities towards their men who had been kept imprisoned without trial. More recently two well-behaved, industrious American workmen were arrested in the city of Mexico and kept four days in prison without a charge being preferred against them. No warrant had been made out for their arrest, and they were prevented from communicating with their friends. Finally they were brought before a magistrate and sentenced to a month's imprisonment for defaming the President. No witnesses were produced, and they were denied the names of their accusers or the particulars of the crime for which they were punished and of which they both declared themselves innocent.

Reducing Expense of Repairs of Railroad Rolling Stock.

Published reports indicate that a substantial reduction in the cost of repairs of rolling stock belonging to the Erie Railroad was effected during the last year. If the machinery can be made to hang together for another year much more favorable record will be made in the expense of repairs, for nothing is being done to any plant belonging to the road that can possibly be avoided. Old engines and cars with every article of scrap not in service are being broken up and sold to aid in the economical showing. The workmen in the shops are working only 36 hours per week, and not a pound of material is carried unless it is needed for immediate use. The Erie is not the only railroad round that is pursuing this policy. Others are attempting to increase net earnings by a similar course. The inevitable result will follow. Engines that ought to be undergoing rebuilding will be kept crawling in the front of trains doing the work at double cost of fuel. Cars will be kept on the road long after they should go through regeneration in the car shop, track renewals will be delayed and repairs neglected with the result that the ditches are certain to receive an abnormal filling up with wrecks. Then, when the road is blocked with traffic that cannot be moved owing to deteriorated rolling stock, expensive renewals and repairs will have to be hurriedly carried out unless a receiver takes charge before this condition is reached.



10-TON POWER FOUNDRY CRANE.

Side Elevation *End Elevation*

An English Railway Accident.

A terrible railway accident recently happened in England, at Penistone, a station between Manchester and London, resulting in the death of twenty-five persons and the severe injury of many more. The accident was caused by the breaking of the crank axle of the locomotive when the train was running at a speed approaching fifty miles an hour. The wheels attached to the broken axle left the rails and derailed all the train. The main body of the train followed the engine over the ties for about seven hundred feet, then a coupling broke and the cars went down an embankment smashing each other into splinters. In many respects the accident has a close resemblance to numerous well-known sanguinary accidents that reddened our railroad annals before the almost universal adoption of the Westinghouse automatic brake on American roads where heavy fast trains are run. That train was provided with a non-automatic brake which lost its hold so soon as the coupling broke and the cars were left free to rush to destruction.

By commission and omission the railway company seem directly to blame for the loss of life. They persist in using a crank axle which is so notoriously unsafe that the Board of Trade returns show that 247 of them broke last year, and the engine-driver of the fatal train admitted to have had these axles break five times in locomotives he had been running. While danger from this admittedly weak mechanical device was always present, they neglected to provide brakes that would mitigate the force of an accident. The British Government and nearly all the technical press have for years urged upon railways the necessity of adopting an automatic brake; but the railways there seem to defy public opinion. In that matter they resemble the position taken by American railroads in regard to automatic couplings and other life saving appliances. They will adopt them when they are compelled to do so by legislative enactments that cannot be evaded.

Considering the calamitous nature of the accident, and the certainty that to defective mechanical appliances alone the disaster was due, it is exasperating to read the self-satisfied expressions of the chairman of the company while speaking about the accident. He was glad to say that, as the accident was one of those which could not be foreseen or provided against, the company were not pecuniarily liable for the death and injury to passengers. As nearly all engineering authorities of any standing in England agree that the accident would have been bloodless had the train been equipped with a brake fulfilling the requirements of the Board of Trade, the railway company will have some trouble convincing juries that the company is not pecuniarily liable for damages. The company will, no doubt, have to pay compensation, as far as money can remunerate, for the loss of life and physical and mental suffering, but justice will fall far short of reaching the guilty parties, since the chairman of the company is not likely to be sent to prison for slaughtering innocent passengers through neglecting to use proper means of safety while operating fast trains.

Whenever a large manufacturing establishment makes a reduction of wages the fact is telegraphed all over the country as a matter of general news, and it appears in most of the daily papers. But when an advance of wages is made, the matter is seldom considered of sufficient inportance for an associated press dispatch. Why?

A Dangerous Anti-Incrustant.

A boiler attendant hailing from the neighborhood of Bury, whose time and abilities, being required for the care of one boiler only, allowed him an opportunity of developing his inventive genius, some time ago discovered a specific for preventing incrustation, which, although possibly quite as valuable as many others which have been offered to the public, we fear, judging from the result of his own experiments, is not likely to make his fortune. He informed the boiler inspector, who came on one of his periodical rounds, that he had been perfectly successful in preventing his boiler from scaling, although using very impure water.

He got a quantity of spirits of salt, he said, in which he dissolved a few oyster shells, and then introduced the mixture in his boiler, with the result that the plates were kept quite free from hard scale. This remarkable discovery, being reported by the

inspector at headquarters, resulted in an urgent request for a thorough inspection being received by the firm from the insurance company. When this was made, the inspector found the plates of the boiler pretty well cleared of scale, but a whitish deposit had settled in the cross water tubes, or Galloway tubes, and, on these being struck with a hammer from the fire side, a hole was easily knocked through every tube in the boiler. The muriatic acid, for which "spirits of salt" is only another name, neutralized only to the extent of the calcium salt formed by the oyster shells which had been dissolved in it, appeared to have settled principally on the inclined surfaces of the cross water tubes, and corroded them internally to such an extent that every tube in the boiler required renewing. Any steam user who is in want of an engine-man of an enterprising and experimental turn of mind has now the chance of being suited, as we believe the man, after his few months' attempt to get a place where he will be better appreciated, will be disposed to hire out his services at a comparatively low figure. It is not long since an engine-man wrote us that he had been trying the effect of oil of vitriol (sulphuric acid) in his boilers, and if he neglect the warning we gave him, and goes on fooling with his acids, etc., much longer, there will probably be another good man at liberty, if, indeed, nothing worse happen.—*Mechanical World.*

Inertia.

By JOHN W. NYSTROM.

In an article on "Inertia Instrument," by E. F. Williams, of Philadelphia, which appeared in the AMERICAN MACHINIST for the 9th of August, it is stated about inertia that "like other great subjects, this one will require years for its investigation, and many years may yet be required for that refinement of knowledge which will subject the mighty inertia forces of the reciprocating parts of an engine to the will of man." This statement encouraged me to venture upon an elucidation of the subject in question, as I have frequently noticed that this subject is not so generally understood as it ought to be.

The mighty inertia is immutable, and will always be independent of the will of man.

Inertia is the incapability of a body to change its own state of motion or rest.

Force of inertia is the resistance of a body free to move, against any external force applied to change that body's state of motion or rest.

The applied force and the force of inertia are action and reaction, which forces are alike.

This subject is the first lesson in dynamics of matter, namely: The force F, is to the mass M, as the velocity V, is to the time T. That is, a force F, applied to a mass M, at rest, but free to move, will give that mass a velocity V, in the time of action T.

F=force of action in pounds.

M=mass of the body acted upon.

W=weight of the body in pounds.

V=velocity in feet per second which the body has attained in T seconds.

T=time of action in seconds.

$$F : M = V : T. \qquad 1$$

Momentum of time FT = MV, momentum of motion.

$$\text{Force of inertia } F = \frac{MV}{T} \qquad 2$$

In the case of the working of a steam engine, the reciprocating parts, which constitute the mass M, have attained their greatest velocity V, when the piston is at half-stroke, when its velocity is equal to that of the crank-pin, namely:

$$\text{Velocity } V = \frac{2\pi Rn}{60} \qquad 3$$

R=radius of the crank in feet.

n=revolutions per minute of the engine.

The time T, in which the piston moves half-stroke, or the crank moves one-quarter of the circle, will be

$$T = \frac{60}{4n} \qquad 4$$

Insert Formula 3 for V, and Formula 4 for T in Formula 2, and we have:

$$F = \frac{M2\pi Rn}{60} \times \frac{4n}{60} = \frac{M8\pi Rn^2}{60^2} \qquad 5$$

The mass $M = \frac{W}{g}$ or the weight of the body divided by the acceleratrix of gravity, which is g=32.17. Insert this value for M, in Formula 5 and we have:

$$F = \frac{W8\pi Rn^2}{32.17 \times 60 \times 60} = \frac{WRn^2}{4608} \qquad 5$$

That is to say, the mean force (in time) of inertia of the reciprocating parts of a steam engine is, for each half-stroke,

$$F = \frac{WRn^2}{4608} \qquad 5$$

This mean force of inertia acts as resistance in the first half of the stroke, and as motive force on the crank-pin in the last half of the stroke.

It is supposed in this demonstration that the connecting-rod is infinitely long compared with the length of the crank, which supposition will not much affect the force of inertia when the connecting-rod is three times, or more the stroke.

Example 5.—The weight of the reciprocating parts of an engine is W=1,000 pounds, making n=265 revolutions per minute with stroke 16 inches, or R=$\frac{2}{3}$ of a foot. Required the mean force of inertia of the reciprocating parts.

$$F = \frac{1000 \times 2 \times 265^2}{3 \times 4608} = 10160 \text{ pounds.}$$

The actual force of inertia of the reciprocating parts at any position of the crank from the beginning of the stroke, is found as follows:

Φ=angle of the crank from the beginning of the stroke. Then the velocity of the reciprocating parts at any position of the crank will be:

$$V = \frac{2\pi Rn \text{ Sin.}\Phi}{60} \qquad 6$$

The force of inertia of a moving body is appreciated only when the motion is accelerated or retarded. When the reciprocating parts move with a uniform velocity, as is the case when the crank passes 90 degrees, or is at right angles to the center line of the engine, there is no force of inertia. The maximum inertia is at the beginning and end of the stroke, and it increases and diminishes as the cosine of the angle Φ of the crank.

This problem cannot be properly solved without the aid of the calculus, which I do not desire to use in the AMERICAN MACHINIST, for the reason that I know that its readers object to complicated mathematical demonstrations. There is a way of solving the problem approximately by calculating the force of inertia for a very small angle of the crank, say for one degree.

$$F = \frac{WRn^2 (\sin.\phi - \sin.\phi^1)}{51.15.} \qquad 7$$

in which $\phi - \phi^1 = 1^\circ$.

The correct formula derived from the calculus is as follows:

$$F = \frac{WRn^2 \cos.\phi}{2930} \qquad 8$$

The maximum force of inertia, which is at the beginning and end of the stroke, when ϕ=0 and cos.ϕ=1, is:

$$F = \frac{WRn^2}{2930} \qquad 9$$

The mean force of inertia in each half stroke is one-half of the maximum force, or:

$$F = \frac{WRn^2}{5860} \qquad 10$$

Example 9, required the maximum force of inertia of the reciprocating parts of an engine of the same dimensions and revolutions as given in example 5:

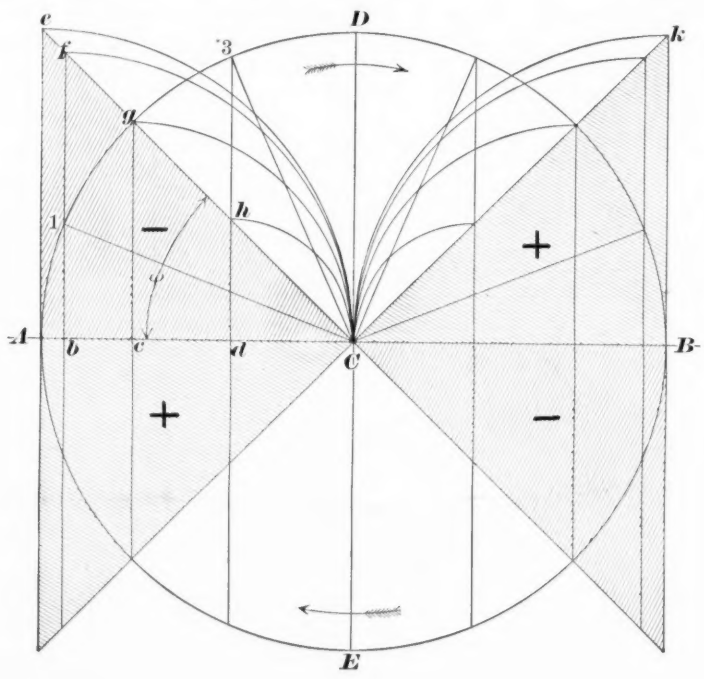
W=1000. R=$\frac{2}{3}$, n=265

Force of inertia

$$F = \frac{1000 \times 2 \times 265^2}{3 \times 2930} = 15978.4 \text{ pounds.}$$

As the force of inertia is proportionate to the cosine of the angle ϕ of the crank, it is very easy to lay down a diagram for inertia as represented by the accompanying illustration.

With the radius of the crank *A C*, and center *C*, draw the circle *A D B E*, which will be that described by the center of the crank pin. Divide the quadrants *A D* and *D B* into any number of equal parts, say four, as shown on the illustration. Through



the division points draw the rectangular ordinates *A e*, *b f*, *c g*, *d h* and *C D*. With *A* as a center, draw the arc *C e*, which will cut *A e* at *e*, then *A e* represents the maximum inertia at the beginning of the stroke; the line *A C B* being the direction of the center-line of the engine.

When the crank is in the position *C* 1, the line *b C* is the cosine for the angle *b C* 1. With *b* as center draw the arc *C f*, then *b f* represents the force of inertia in that position of the crank. When the crank is in the position *eg* or ϕ=45°, then *c C* is the cosine, and with *c* as the center draw the arc *C g*, then *c g* represents the force of inertia, and in the same way *d h* represents the inertia when the crank is in the position *C* 3. When the crank passes the position *C D* at right angles to *A B*, the motion of the reciprocating parts is uniform and exercises no inertia. Now join the points *e*, *f*, *g*, *h*, and *C*, which will be a straight line, and the shaded triangle *A e C* represents the diagram of inertia in the first half part of the stroke, which inertia is negative or acts as resistance to the motion.

The diagram *C k B* for the other half of the stroke is constructed in the same way, but represents positive inertia which acts with the motion as motive force.

It is supposed in the forgoing demonstration that the rotation of the crank is uniform or regulated by a fly wheel.

The ordinates *A e* and *B k*, represent the maximum inertia given by formula 9, and any other ordinate in the diagrams is given by the formula 8.

The inertia instrument, invented by Mr. E. F. Williams, it appears, gives a curved line in the inertia diagram, which error is probably caused by the motion of the inertia mass, and is not the same as that of the cross-head on which the instrument is fixed, and it can therefore not give a true diagram. The calculations and scale measurements necessary with this inertia instrument are unreliable, and require more time and expense than that of calculating the inertia correctly by formula 9, which formula is ready for use without operation of the engine. The inertia instrument may be considered useful by those who do not understand dynamics of matter, and who have no faith in mathematical demonstrations.

The back-action horizontal propeller engines, constructed by Chief Engineer Isherwood, were much complained of in technical journals, which stated that "the enormous reciprocating masses of iron absorbed most of the power by being set in motion and stopped at each stroke." The fact is that there was no power at all lost by that means, but the inertia of those heavy reciprocating parts acted beneficially on the uniform motion of the engines, particularly when high expansion was used. The forces of inertia of heavy reciprocating parts, however, act to shake the vessel, which is a great inconvenience in small steamers, but engines can be constructed in which the forces of inertia neutralize one another.

Personal.

A. G. Brown, for some time past assistant superintendent at the Westinghouse Machine Company's Works at Pittsburgh, has, at his request, been transferred to the New York office of that company. Mr. Brown's health has been somewhat impaired, as he believes, by close confinement to the shop and drawing-room (he having sole charge of the latter at Pittsburgh), and he believes that outside engineering work for a time will be beneficial. Mr. Brown has many friends in this section, who wish him every success.

Cotton Picking Machine.

"Bill Arp" gives the following description of a new cotton picking machine, the invention of Mr. Mason, of South Carolina. "The inventor showed me the little revolving tubes that pick the cotton from the bolls. It is seven inches long and about 1¼ inches in diameter. This little thing is the invention. All the rest of the contrivance is to put it in motion. Four dozen of them will be working at once on a cotton stalk, and if there is any cotton open they will find it. There are two upright cylinders three feet high, that straddle a cotton row like a sulky plow straddles a row of corn, and these little tubes revolve horizontally in the cylinders. They turn round and round rapidly. The cylinders revolve on their axis, and these tubes revolve on theirs as they follow the cylinders round and round. They are sure to touch every boll, and if the cotton has opened and swells out a fraction of an inch the little delicate points of the pickers get it and roll it all out in an instant, and by a reversed motion unload it on a platform, and from there it is carried up and put in a sack and packed until it is full.

"Horse power pulls the machine along the row. The machine weighs 300 pounds. Some of them are made for three-feet cotton, and some for four and some for five. I saw the little spindles set to work on cotton bolls half opened, and they left nothing; and yet they will revolve in your hand and not hurt you or prick you. There are 300 sharp points in each spindle. They are just under the surface, and will catch the lint, but not catch your flesh or the leaves or the stems. The imperfect machine of last year picked 300 pounds an hour. The perfect machine which he has now is expected to pick 600 pounds an hour. Mr. Mason has his own machinery, makes his own lathe and his dies and stamps and wheels and everything. He is backed by capital unlimited, and has refused a million dollars that was offered him. He is making large machines for Texas and Arkansas, and smaller ones for the Eastern States. His plan is to charge a royalty, and

let the machines be made anywhere. It is a thing of life and sense, and does just what you tell it to do. When the cotton is well open for the first picking it goes along and picks it, and then you wait for the next picking. It takes in no trash or dead leaves —nothing but cotton.

"Now he has a gin that operates on the same principle. These little pickers have expanded into a cylinder as long as the shaft and as large round as a gin saw, and they catch the lint, and an iron bar keeps the seed from following the lint, and forces them back. The lint is not cut or torn. He is using an old gin frame, taking out the saws and putting his cylinders in their place. It gins twice as fast as the saws, and there is no danger to hands or arms. I put my open hand on the cylinder while it was making 2,000 revolutions a minute. He dropped a handful of shingle nails in the opening, and they were carried through in an instant and did no harm. Experts from northern factories say the lint is worth ten per cent. more than lint cut by the old method."

Fitting and Care of Axle Boxes.

BY J. D. CAMPBELL.

INFLUENCE OF HALF ROUND BRASSES.

Driving boxes fitted with a half round brass have a tendency to close at the bottom. This tendency is continuous and becomes most marked as the brass wears down, relieving the box of the strain put upon it by the tight fitting brass. With a properly fitted brass and a collar put up in good shape the box cannot close much, still there will be enough looseness to cause a slight pounding. During the first few days' service of a locomotive after new driving brasses of this shape are put in, the compression on the brass, resulting from the weight of the engine, tends to close the bottom of the box and permits the box to rock. This evil may be to some extent prevented by fitting the wedges slightly closer at the bottom. This closing of the box at the bottom is not only an evil and annoyance in itself by causing pounding, but is a further source of trouble by hastening the forming of a shoulder on the top of the wedge. The tendency at all times is for the axle box to wear a shoulder at the top and bottom of its travel, even when the box retains its proper shape; but when it is distorted by closing at the bottom, the rubbing surfaces are put out of the true plane and wear takes place much more rapidly. While the springs retain their position and impart to the axle box a fixed range of motion no serious effect is felt from the worn wedges. But when the locomotive is passing over rough frogs or bad rail joints where the motion of the spring is increased the frame pounds down upon the box, which for a moment becomes fastened in the narrow space between the shoulders of the wedges, and an effort is needed for the box to relieve itself and allow the spring to resume its motion. This causes the engine to ride hard in some instances where the condition of the track makes the box catch frequently. Sometimes the box will be unable to relieve itself without assistance and much loss of time and annoyance result when the wedge has to be pulled down to relieve the box.

The forming of the shoulder on top and bottom of the wedge may be anticipated and prevented by planing the part where the ridges form, leaving a face just the length of the box plus the space covered by the motion of the springs. Not only does this aid in preventing the box from forming a shoulder, but it also reduces the first cost of fitting the wedges by reducing the surface to be squared and finished true.

POSITION OF BOXES WHILE SETTING UP WEDGES.

With the wedges in a proper condition when the locomotive enters service we yet must care for them and adjust them from time to time when it is necessary to take up the lost motion between the pedestals and boxes. When doing this work it is important that the position and condition of the driving box should be considered. The position of the box should be such that the wedge may be set up to the proper degree of tightness with certainty and without much labor. It is important that a wheel position be found where the box would not be moved by the wedge when the latter is being adjusted. This position will be found where the box is up against the dead wedge, since the lost motion will then be between the box and the wedge to be moved. To get all the driving boxes in that position at one time is a difficult matter if it is to be done by pinching the wheels. The position of the rods decides the direction of their action on the wheel by the thrust or pull upon the crank pin. If the rod is above the wheel center, pinching behind, the back wheel will force both the wheels and boxes on that side up against the dead wedge; but should the rod be below the wheel center similar work with the pinch bar will draw the forward box away from the dead wedge, the side rod doing this by pulling on the crank pin—this is always supposing the dead wedge to be in the front pedestals. The best position therefore to get an engine into for setting up all the wedges is with the side rods on the upper eighths, for then pinching behind the back wheels will push all the boxes up to the dead wedges. The work can then be done without putting unnecessary strain upon the wedge bolts which are often found with the corners of the heads rounded off, and the thread injured to such an extent that it will not screw through the binder brace, a condition of matters nearly always caused by trying to force up wedges without putting the engine in the proper position. If the wedge bolt from faulty construction, or through injury, is unable to move up the wedge, driving is resorted to by which means it is battered on the end, and the jarring of each blow causes the ashes and dirt on top to fall behind the wedge throwing it out of parallel and introducing material that will cause the wedge to cut. The ashes and dirt that accumulate so readily on the top of wedges and boxes cause no end of trouble although the fact is not generally recognized; and it will generally be fruitful labor to have these parts well cleaned off before beginning to set up wedges. Many complaints that are made of wedges not being properly adjusted proceed from the disturbance that follows grit introduced between the wedge and box.

NECESSITY FOR KEEPING BOXES AND WEDGES CLEAN.

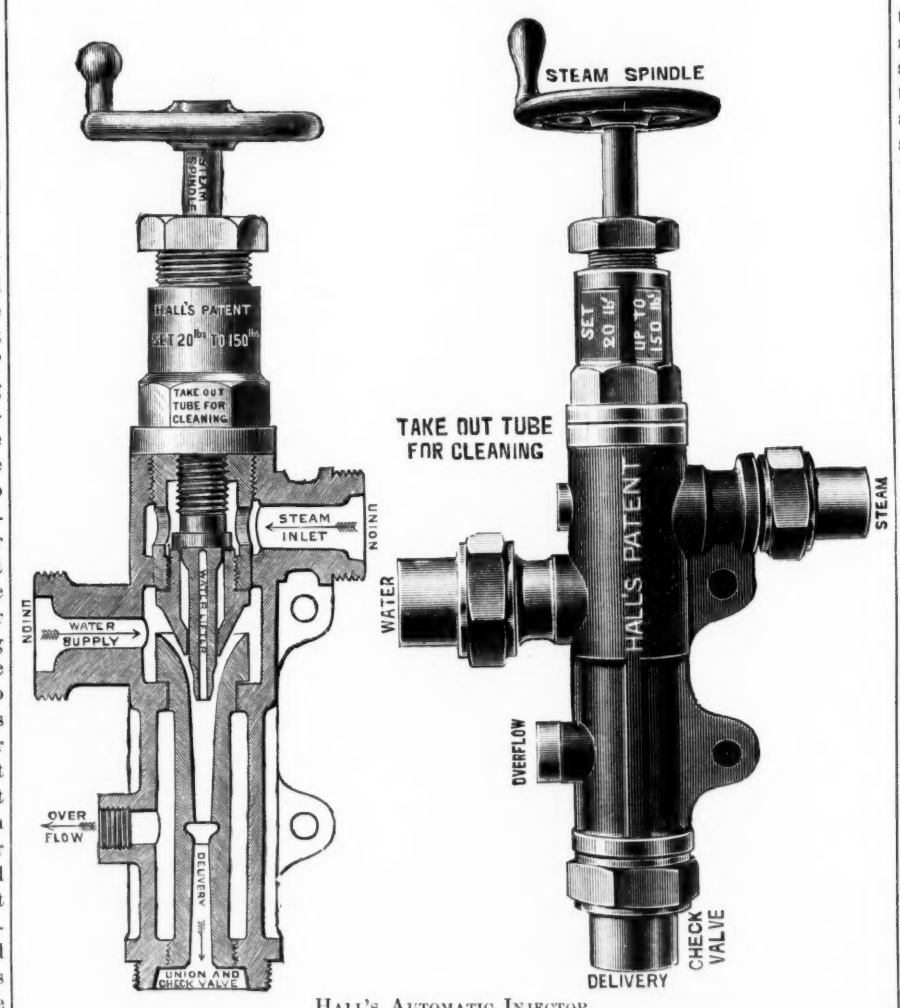
The growing practice of close and stated inspection of locomotives to detect defects, before waiting for them to develop into breakages that cause trouble and delay to trains, will give especially good results if applied to boxes and wedges. If the wedges are taken down and examined at regular intervals the ridges that appear so readily on the face, when oil grooves are cut on the sides of the driving box, can be smoothed off before they cause distortion of the surface. This is also a good time for a thorough cleaning of the pedestals and box and the oil holes can be examined and opened out properly. Work of this kind often prevents boxes getting hot on the road with all the entailed delay and expense which often includes changing engines if the train must be pushed on. One turn of a hot box will often wear a brass more than the daily running for two years.

TEMPERATURE OF THE BOX TO BE CONSIDERED.

One condition of the box to be considered when adjusting wedges, is its temperature at the time the work is done and what that will be when the engine is in service. Adjusting wedges is often done as a preliminary step to lining and adjusting side rods, and this is done on many roads on the shop day when the locomotive is in for washing out and periodical repairs. At that time the engine being cold the boxes will be at their lowest temperature, and consequently at their smallest dimensions. Allowance should then be made with the wedges for some expansion of the boxes. Another condition that should be considered is how the box has been running. A box that has been running hot or warm generally compels the wedge to be lowered to allow for extra expansion. When this box has been repacked or otherwise cared for the wedge is again set up. While doing this it should be remembered that a box that has been running hot is liable to be distorted and its journal bearing injured, so that it is likely to run warm for some time till the brass comes to a smooth bearing. If the wedge will not permit the box to expand it binds the journal and is likely to run still hotter, and is liable to stick in the jaws.

SMALL DISORDERS THAT CAUSE ROUGH RIDING.

Many complaints are made about pounds in driving boxes and wedges, when the trouble really exists elsewhere. Boxes with driving spring saddles whose foot is but the width of the top or spring band will ofttimes, if the band is not rounded where it rides on the saddle, or is not fitted with a pin or other center bearing, tip on the box with each motion of the spring. Or if the saddle is moved from its worn seat on the top of the box, it will rock and pound. Again, obstructions in the bearing of the spring equalizer that will prevent the full motion of the springs and bring them to a sudden stop, will produce a motion resembling that caused by a stuck box. Attention to details that are sometimes considered the crude parts of a locomotive will often prove highly beneficial to the working of the locomotive, and especially is this the case with the parts that transmit the motion of the springs.



HALL'S AUTOMATIC INJECTOR.

Hall's Automatic Injector.

We present with this engravings representing one of this class of injectors now being introduced in this country by Hall's Engineering Company, 112 John street, New York City. These injectors are made in a variety of forms to suit varying purposes, the one here represented being that known as the "D. L." class, more especially designed for locomotives, traction engines, tram-car engines, steam yachts, fire engines, and for purposes where the variation in steam pressure is likely to be excessive. Used for these purposes they are said to be unaffected by jar and concussion.

It will be seen that, by means of the screwed top, the spindle and attachments can be most readily removed, should it become necessary, for cleaning, the time required for doing this being very short.

It is claimed for these injectors that they are very simple in construction, that they are made in variety to suit every purpose, that they may be set in every desired position, immersed in the water if desirable, that they will feed through very wide range of pressures and cold or hot water, that there are no delicate parts likely to get out of order, that the motions required to work them are reduced to a single one, and that they will handle a large amount of water for their nominal size. All injectors are tested under working conditions before leaving the works. The sectional engraving shows the arrangement of parts so fully as to render a detailed description unnecessary.

German Engine Drivers.

A correspondent of the *Railway Review*, writing about English and German engine drivers, makes out that the latter receives much the better training in learning his business. He asserts that young Germans intended for locomotive engine drivers have to go through a technical school course, from whence they enter the railway fitting shops to learn some mechanical work. After having spent one or two years in the locomotive workshop, he is sent into the running shed to learn how to make current repairs. When he is old enough to be entrusted with a responsibility, he has to do at least a year's firing under one of the ablest engine drivers of the railway, who has to be strict with him, and must show him everything connected with the management of the engine. After he has served the necessary time as fireman he has to pass a practical examination, that is, to make a trial trip, on which he is accompanied by the engineers and other local authorities, who have to judge if he can be safely entrusted with a locomotive.

His next job will be to do a lot of shunting; then he will have to drive eight-coupled mountain engines, afterwards the six-coupled, and so on, until he rises to the post of first-class or express engine driver, the *ne plus ultra* of the calling, to which many aspire, but few are selected. These engine drivers are superior men in every respect, of undaunted energy, thoroughly acquainted with their engines; many of them are learned men, and fit to fill up the post of engineer. When not at work they look like gentlemen.

This system does not exclude firemen from advancing to the post of engine drivers,

when, after some years' running, they have distinguished themselves by their punctuality, cleanliness, and especially by their sobriety.

The position of the engine driver abroad is not well paid, it is true, but their lot is more enviable, especially those where the State manages. They are allowed so much a month for house rent; they have also mile money (meilengeld), besides coal and punctuality premiums. The working hours are not so long, and on many lines every third day is a day for rest.

LETTERS FROM PRACTICAL MEN.

Sand Drying Device.

Editor American Machinist:

In your issue of July 26 you ask anyone having a satisfactory arrangement for drying sand to describe the same for the benefit of your readers. I have found the following an excellent sand drying rig, and have had it in use for a good many years:

Take lengths of $\frac{3}{4}$ inch gas pipe and make them in sections of the length and width desired, using close pattern return bends on the bottom coil, which will leave the pipes $\frac{3}{8}$ inch apart. The sand will not drop through that space when moist. The second section should be made with open pattern return bends, which will leave the pipes $\frac{3}{4}$ or 1 inch apart. The third and fourth sections should be made with elbows and nipples, to leave the space 3 inches between the pipes. All the sections should be connected together so that the steam will pass from the top section into the next below, and so on, with the outlet at the end of the bottom section. The sections should be 4 inches apart. Build a box around the pipes to hold the sand, and leave a space under for the sand to drop. The box can be filled up, and as fast as it dries it will drop through the pipes. The pipes should be filled with steam at boiler pressure, and the outlet should be regulated to allow the condensed water to pass off.

I put in an arrangement of this kind seven or eight years ago for a firm I worked for. The pipes were 16 feet long and the box was $3\frac{1}{2}$ feet wide, with sections as above described. It dries sand for a glass manufactory, and dries more than a kiln did that was 18 feet long and 3 feet wide. While it needed 25 bushels of coal to run the kiln, the pipe arrangement can be operated with from 7 to 10 bushels, and does the drying with less attention. The box should be made tapering wider at the top than at the bottom.

Anyone wishing to see the arrangement can do so by calling on me.

JAMES CROWLEY,
Engineer, Stearns & Foster Co.
Lockland, Ohio.

Removing Nuts from Hand-Hole Bolts—Loosening Man-Hole Covers—Breaking Water Line Glasses to Length.

Editor American Machinist:

The nuts on hand-hole plates at the rear end of a horizontal tubular boiler being exposed to considerable heat, are very apt to stick. The most common way of removing them is to use a hammer and chisel, which either breaks the bolt or takes the corners off the nuts. My plan is, at night to saturate a piece of cotton waste with kerosene oil and lay it over the nut till the next morning; then I frequently find I can remove it with my fingers, not requiring even a wrench.

It frequently takes hard hammering to get man-hole covers loose. I fill the annular space around the outside with kerosene, and the next morning find the rubber and scale entirely loose, and can remove the cover without trouble.

To cut a water line glass to right length, I wind a fine cord each side of where I want to break it, leaving room between the two cords for a thicker cord; then put cloth around the glass and hold it in the vise, pass the thick cord (about three feet long) once around the glass between the two cords, pull it back and forth till it burns, cool the hot place in the glass with water, and it will break square across. This is much better than using a file, as then you are never sure where the glass will break. J. MAY.

Rubber Packing—Testing Boilers.

Editor American Machinist:

I notice an inquiry in your issue of August 16th about the use of rubber as packing for an engine. While it might not be injurious to iron, it would be injudicious to use it on brass stems or rods, on account of the sulphur which it contains, and which has as corrosive an action on brass as acid has on iron.

Mr. William Lowe is sound on the boiler test question so far as the amount of work done per square foot of heating surface goes, but it is hardly fair to lay all the blame on the men who make the test, unless they have the control of setting the boilers, as the ratio of heating to grate surface is arranged or determined by the party building the boiler. The conditions cannot be the same until boiler makers come to some uniform standard of the proper amount of coal to be burned per square foot of grate per hour.

One builder believes in a slow combustion, and puts in a large grate so as to get the full capacity of his boiler with a low fire. Another builder, who has studied the habits of steam users, and is cognizant of the fact that they usually run a boiler for all it will do before purchasing new, or he may believe in a rapid combustion and consequent high temperature in the furnace, will put in a small grate, and the probabilities are that he will get the best results.

I have two kinds of boilers set in the same room, and connected to the same chimney. The makers of one style calculate fifteen feet heating surface for one horse-power, and one square foot of grate for two horse-power, and a combustion of about five or six pounds of coal per square foot of grate. The makers of the other allow eleven feet heating surface per horse-power, one foot grate for four and a-half horse-power, and want a combustion of not less than fifteen pounds of coal per square foot of grate.

Now, no man can make these conditions equal. The builders made the conditions unequal, and the man making the test should not be blamed. The party that gets beat should abide by the result of his own miscalculation, and if he can't make his ideas a success, either change his plans or get out of the business. The conditions will never be alike until all men think alike, and the man whose ideas give the best results will get the most orders as a general rule.

W. E. CRANE.

Waterbury, Conn.

Driving Boxes and Wedges.

Editor American Machinist:

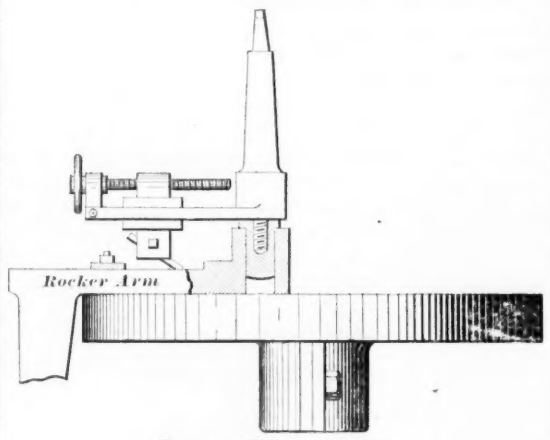
With reference to J. D. Campbell's communication, on fitting shoes and wedges, there are other causes of trouble in driving boxes. One is the varying size of outside flange on shoes, and wedges and boxes, caused by changing the boxes round so as to get a better face for the wheels to bear against, and changing the shoes and wedges to opposite sides of the engine, the various sizes causing the boxes to stand atwist.

It often happens that shoes and wedges are not properly trued up during repairs, the faces frequently being $\frac{1}{8}''$ out of a vertical line, causing a diagonal motion of the box; and again, the faces of the front shoes are at unequal distances from the center of center casting. The greatest care is required in locating the centers of right front and left front pedestals, being careful to get them at exactly equal distances from center of center casting, and placing a vertical line on each side of each shoe and wedge, to set them by for planing, making a fine prick-punch point near the end of each line. In planing some set the points level with a surface gauge, but a good way to set them is to use a pair of hermaphrodite calipers, from the points to face of chuck, having the shoe or wedge packed up solid with pieces of tin, paper, etc. Having got them about right, take a cut over the face, then caliper from points to face of cut. The points showing the shortest distance from the face will require to be lowered and the longest points raised. By using thin paper you can make a very fine adjustment. Sometimes it will be found that all four points are not in the same plane, but if they don't vary more than $\frac{1}{64}$ of an inch the distance can be divided between opposite points, and it will not seriously affect their parallelism when in place. If the variation is more than this the cause must be looked for, and the points made correct. About $1\frac{1}{2}''$ of the face of the shoe on top and the same at bottom should be filed away, so that the box will pass by and avoid wearing a shoulder in the shoe, which will cause a pound. A SHOPMAN.

Method of Turning Ends of Rocker Arms—Boring Car Boxes.

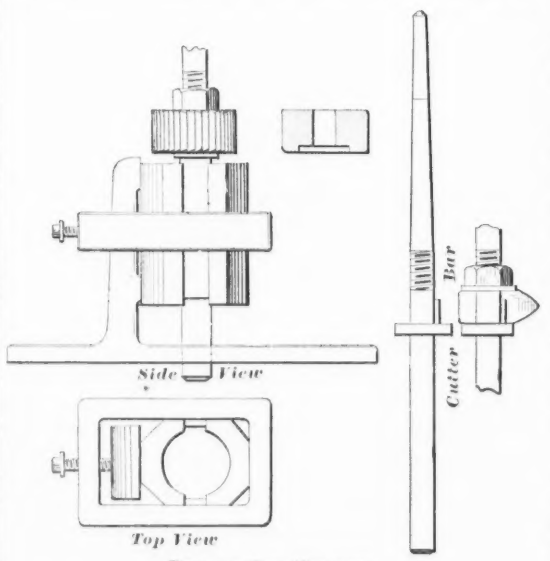
Editor American Machinist:

I was visiting a shop in the East, not long since, where several new engines were under course of construction, and, in noting the different points of interest, I was struck with the considerable amount of labor expended upon rocker arms, especially the turning up of the outer ends of the arms in the lathe. The machine being of insufficient swing, it was blocked up, the boss on the arm extending fully 18″ from the face-plate, requiring the closest vigilance on the part of the operator to keep the work from chattering, and possibly gouging. The foreman pointed out this job to me as one of his fine lathe operations, of course somewhat expensive, but the only facility the shop affords, you know, said he. Right there my mind wandered to the Burlington and Missouri River Railroad shops in Plattsmouth, Neb., to a plan gotten up by the foreman for doing this very particular job on a very common drill press, in this manner: The rocker arm, of course,



TURNING ROCKER ARMS.

is turned as far as possible on the centers; from them it is taken to the drill press, where the offending arm and boss are bolted to the drill table, the body and opposite arm hanging outside and below the table, being then in a position where the manipulator of chattering tools mourns his loss, for we have the part to be operated upon within one inch of the great anvil principle. Next a hole is drilled in the boss $\frac{1}{32}$ smaller than the finished size; a tool like that shown is placed in the drill spindle; the cutting tool is either fed by hand or a projection on table strikes the star handle. When the arm is finished up to the boss, the drill spindle and tool are raised, and a cut started upon the boss and fed down by the drill feed. Lastly, a finishing reamer is put through the hole, and the job passes along to the next man, and not a murmur is heard. The cut shows the parts so plainly as to need no further description.



BORING CAR BRASSES.

By the way, my Western friend called my attention to a kink which he had gotten up for boring car brasses on the drill, which he claims is the boss. The drawing will explain itself. The arrangement is very simple, and pays for itself in a short time. Brasses with lugs and projections are accommodated by a different-shaped strap, and it is a matter of opinion as to whether a single cutter is used or a standard-size milling cutter; but he says, "I prefer the mill, it being easily ground upon the emery wheel, and lasts a long time." L. C. SHARP.

Plattsmouth, Neb.

Proportioning Slide Valves and Determining the Effect of Different Proportions.

Editor American Machinist:

I wish to call the attention of such of your readers as have started to follow our method of drawing valve-motion diagrams to Fig. 1 (on opposite page) to show one other point, and that is that the greatest distance from the line *E* to the circle *A* is the greatest width of port opening.

Fig. 2 is simply a reproduction of Fig. 1, with the addition of a circle and line, which solves the second and third problems, which are: to determine the point of exhaust opening, and the point at which compression begins.

If the valve has inside lap—that is, if when the valve is set centrally the steam cannot escape from either end of the cylinder—then draw the circle *c*, Fig. 2, with a radius equal to the inside lap of the valve. Draw the line *g* parallel with the line *e*, and, where this line strikes the circle *a*, at *h*, it will represent the point where the crank will be when exhaust takes place; and, where this line strikes the circle *a*, at *i*, it shows where the crank will be when the exhaust closes and compression begins.

If the valve has neither lap nor inside clearance—that is, if the opening in the valve is just equal to the exhaust port and bridges—then the line *g* should be drawn through the center of the circle, or, if the valve has inside clearance, then the line should be drawn to strike the upper side of the circle—the circle to be drawn with a radius equal to such clearance.

So far the diagram gives only the position of the crank, and no definite position of the piston in the cylinder, although to determine this but a very few more marks are required. Owing to the different angles the connecting rod assumes, the piston occupies unequal positions at the opposite ends of the cylinder, while the crank occupies equal distances from the dead center.

Many times it is more desirable to know what the average of these positions is than the actual positions, and this may be determined in the manner shown in Fig. 3. Divide the line *B* into as many equal parts as there are inches of stroke in the cylinder, or tenths if it is desirable to have the result in per cent. of stroke. (In the diagram I have assumed that the engine has a 12 inch stroke, and have divided the line into twelve equal parts.) Then draw vertical lines from the points *f*, *h* and *i* to the center line *B*, which will indicate that the average cut-off takes place at about $8\frac{3}{4}$ inches, exhaust at about $11\frac{1}{4}$ inches, and that compression begins at about $10\frac{3}{4}$ inches.

To determine the actual position of the piston at the two ends of the cylinder with any length of connecting rod is equally simple, as will be shown hereafter.

JOHN E. SWEET.

Syracuse, N. Y.

The Philadelphia Electrical Exposition.

Those having charge of the coming Electrical Exhibition at Philadelphia are doing themselves and the city credit by the vigorous way they are pushing forward the work connected with the building. The outside of the building is about completed, and the inside work, preparatory to taking in exhibits, is progressing rapidly. The foundations for the five engines that will run the machinery are about finished, and the shafting is being put up. Several of the engines will be of the Porter-Allen type, the largest 300-horse power. In the center of the hall there will be a fine electrical fountain, which is nearly completed. Among the curiosities that will be seen at the exhibition will be the original Morse telegraph instrument, upon which the first message ever telegraphed over a wire was sent from Washington to Baltimore. As a comparison with the simple key instrument used by Professor Morse, there will be exhibited a synchronous multiplex telegraphic machine, by which one operator can send seventy-two messages at once over one wire. There will also be an electric chicken-hatching machine and many other interesting curiosities.

In a recent consular report, Consul Warner, of Dusseldorf, Germany, says that the demand for labor in his district has very much increased of late years, and wages have been greatly advanced, so that the social condition of workmen has been materially improved. This district is a great center of iron, steel, and coal industry, and it is in connection with that business that the growing prosperity exists. Careful investigations were made to ascertain what caused the unwonted progress of the district, and all authorities agreed in attributing it to a change in the tariff which gives protection to the native iron trade.

Warner & Swasey's Method of Sizing Gear Wheels.

We are indebted to Warner & Swasey, Cleveland, Ohio, for the engraving and text on this subject. In a letter to us they say: We have a great many gears sent us for cutting, the blanks of which are improperly turned—so much out as to be spoiled—so it was a necessity that some simple rules be furnished by which such mistakes could be avoided, hence the following:

The cuts of spur and bevel gears were engraved directly from the drawing and by their aid we will endeavor to give some directions by which all diametrical pitch gears can be laid out preparatory to turning and cutting.

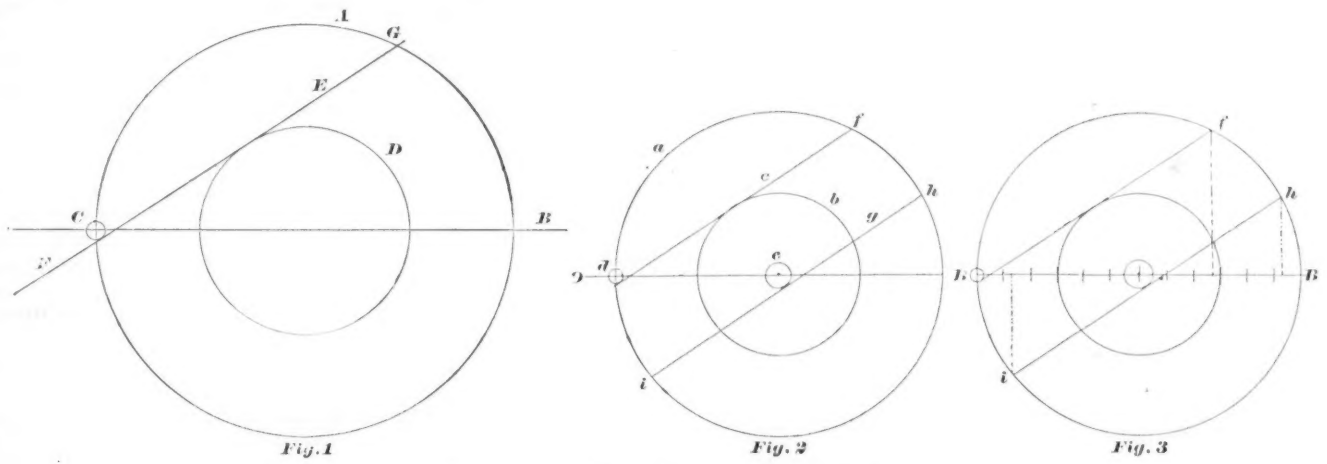
In spur gears, first decide upon the pitch, which means the size of teeth. Should it be 8 pitch, as shown in cut, draw a circle measuring as many eighths of an inch in diameter as there are to be teeth in the gear. This circle is called the pitch line. Then with a radius $\frac{1}{8}$ of an inch larger draw another circle from the same center, which will give the outside diameter of the gear, or $\frac{2}{8}$ larger than the first circle. Thus we have for the diameter of an 8 pitch gear of 24 teeth, $\frac{26}{8}$. Should there be 16 teeth, as in the small spur gear, the outside diameter would be $\frac{18}{8}$, the number of teeth being always two less than they are 8ths—when it is eight-pitch—in the outside diameter.

From the pitch line to the bottom of the teeth it is the same distance as to the top, excepting the clearance, which is always one-eighth of the pitch, making in the example $\frac{1}{64}$. Thus the tooth measures $\frac{9}{64}$ from the pitch line to the bottom of the space; but the clearance being provided for in the cutters, the two gears would be laid out to mesh together just $\frac{2}{8}$.

These rules apply to all pitches, so that a five-pitch gear with 24 teeth would have an outside diameter of $\frac{26}{5}$; or if three-pitch, 40 teeth, it would be $\frac{42}{3}$. Again, if a blank was $4\frac{1}{8}$ $(\frac{25}{6})$ in diameter and cut six pitch, it should contain 23 teeth.

In laying out a pair of bevel gears, after deciding upon the pitch, draw the center lines B B and C C, intersecting at right angles at A. Then draw the lines D D and E E the same distance each side of B B and parallel to it, the distance from D D to E E being as many 8ths of an inch—if it be eight-pitch—as there are teeth in the gear. In the example the number of teeth is 24; therefore, the distance from D D to E E will be $\frac{24}{8}$, or $1\frac{1}{2}$ inches each side of B B. K K and L L are similarly drawn, but there being 16 teeth in the small gear the distance from K K to L L will be $\frac{16}{8}$, or one inch each side of C C. Then, through the intersections of D D and L L, E E and L L, and E E and K K, draw the diagonals F A. These are the pitch lines. Through the same points draw lines, as G G, at right angles to the pitch lines, forming the backs of the teeth. On these lines lay off $\frac{1}{8}$ of an inch each side of the pitch lines, and draw M A and N A, forming the faces and bottoms of the teeth. The lines H H are drawn parallel to G G, the distance between them being the width of face.

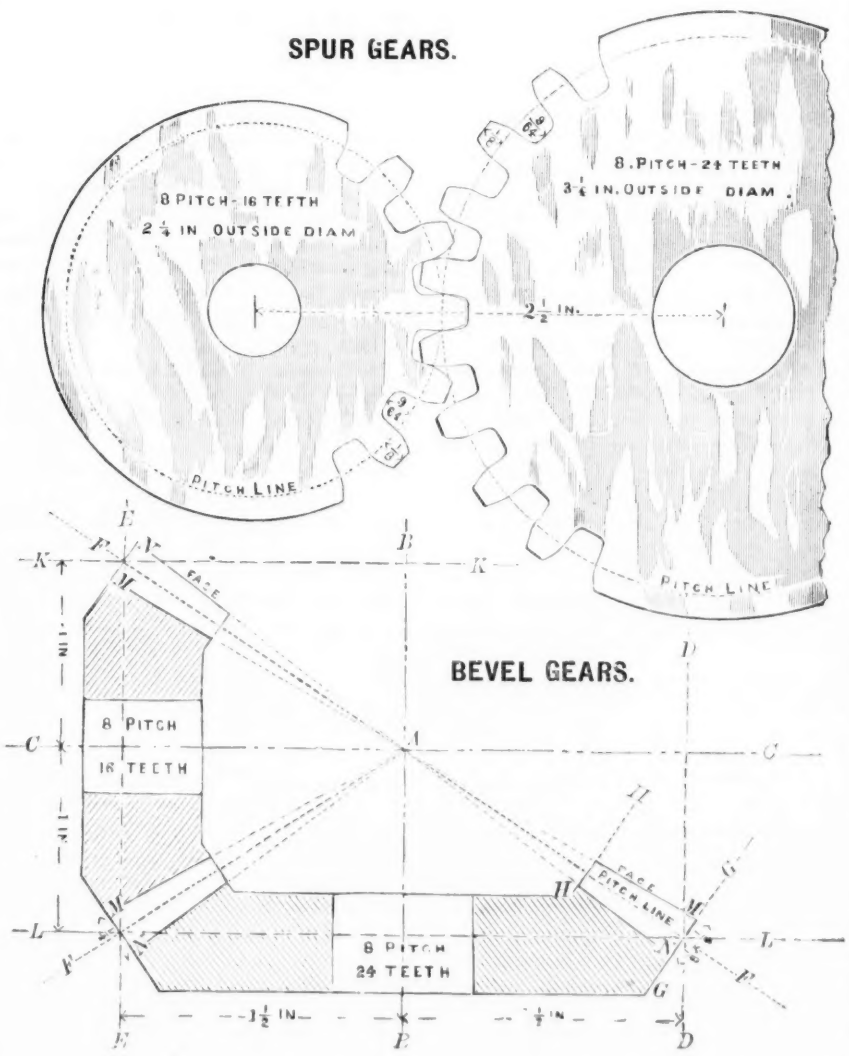
The face of the large gear should be turned to the lines M A, and the small gear to N A. For other pitches the same rules apply. If four-pitch, use 4ths instead of 8ths; if three-pitch, 3ds, and so on. Bevel gears should always be turned to the diameters and angles of the drawings.



PROPORTIONING SLIDE VALVES.—(SEE PAGE 6).

National Convention of Fire Engineers.

The twelfth annual convention of the National Association of Fire Engineers, according to the official announcement signed by President O'Connor and Secretary Hills, will be held in Chicago, commencing Tuesday, September 9, 1884, at 12 M. The chief officer, representative of each fire department, and superintendent of insurance and fire patrol, in the United States and Canada, are invited to attend. A special invitation is extended to boards of fire commissioners and representatives of insurance companies to be present. Inventors and manufacturers of improved apparatus for the extinguishment of fires and fire escape apparatus will be afforded every facility for the exhibition of their several inventions which they are desirous to display. This will be particularly advantageous, as getting them passed upon bp practical firemen, expert in their business.



The State of Hidalgo, Mexico, has voted to pay a subsidy of $1,500 per kilometer to the projectors of the new cable road soon to be constructed in the City of Pachuca by Mr. Andrew S. Halliday, who has the exclusive privilege throughout Mexico, during ten years, for building and operating all such roads. Mr. Halliday uses the same system now employed in San Francisco and Chicago. Mr. Jose Godoy, general agent of the Cable Road Company, left the capital on Wednesday for San Francisco, where he goes to obtain engineers, who will at once begin the work of constructing the cable road at Pachuca. Arrangements are being made for similar roads in the capital and other large cities of Mexico.

Hydraulic Distribution of Power.

According to *Engineering*, the hydraulic distribution of power in Hull has, so far, proved entirely successful, and the company organized in 1882 to operate in London is meeting with the same kind of success. The plan is to force water by means of a hydraulic pumping engine into an accumulator, from which it is conveyed by divergent mains in various directions, under a pressure of about 700 lbs. per square inch. Power supplied in this way can be used for producing rotary motion, but its advantages are greater in apparatus requiring rectilineal motion, such as elevators, and various kinds of hoists, presses, etc.

There are at present in operation by the London company two centrifugal pumps, raising water from the river. The water is allowed to settle, and is passed through self-cleaning filters to a second tank, from which the main pumps take it. These pumps deliver it to two accumulators, loaded to a pressure of 700 lbs. per square inch. Two sets of pumping engines, each of 160 indicated horse-power, are in position, and another set is being constructed. From the pumping station pipes extend in all desired directions. The arrangement of the pipes is such that they can be fed from either end, and stop-valves are placed at frequent intervals, so that if a break occurs at any point it will not be necessary to shut off more than a few consumers during the time occupied in making repairs. The mains are of cast-iron, 6″ diameter, in lengths of 9 feet, tested at the works to a pressure of 2,500 lbs. per square inch. The joints are turned and bored spigots and sockets, made tight with gutta-percha rings.

In addition to the use of this system for power, it is claimed to be especially valuable in case of fire. For this purpose a small quantity of water in the form of a jet, under 700 lbs. pressure, is made to take up a large quantity of water at low pressure, and force it against the fire, the principle being the same as that of the ejector. As the water will most naturally be used for power in large warehouses and mercantile establishments, the advantage of having such means of subduing fire, always ready on the instant, will be apparent. The cost of water to the consumer is said to be very moderate—much less than getting power by other means—besides the saving of space, a particularly valuable feature in London.

It is announced in a Western paper that the Barney & Berry Manufacturing Company will hereafter make skates at Springfield with a 65 horse-power Westinghouse automatic engine. We hardly think a good Westinghouse engine will provide much good material for making skates.

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NEW YORK, AUGUST 30, 1884.

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A Manufacturing Corporation's Objections to Trade Combinations.

We have been interested in the perusal of a circular letter, in which a company engaged in maufacturing saddlery hardware explain, to the members of the Saddlery Hardware Manufacturers' Association, their reasons for declining further action with that organization.

After enumerating the lines of manufacture instanced, as working most successfully in combination, viz.: the rivet, nail, hoop iron, tack, and, more particularly, the wall-paper trades, they call attention to the fact that these instances are not parallel to the intricate and diversified line of saddlery goods, largely produced by hand labor. They note the ease with which saddlery hardware manufacturers, producing, as most of them do, lines of specialties not in the combination, can use these as leaders to influence sales, while nominally adhering to combination prices on other goods.

After further enumerating several circumstances incident to that business, they reach the conclusion that the success of the wall-paper manufacturers in maintaining combination prices is due to the fact of their being practically manufacturers of a non-diversified product, produced entirely by expensive machinery, which insures them against the inroads of manufacturers with small capital; to the fact that on account of the large production in these limited lines, it is practicable for the manufacturers to carry the stock for the jobbers; and finally, to the fact of the manufacturers' peculiar relations with and control of the small dealers.

The state of things prevailing in this important industry is, or may be, in these times when so much is said about overproduction, of interest to persons who contemplate engaging in manufacturing pursuits.

Another objection urged, forcibly, is that under the combination plan, the three or four members of the executive board have, by virtue of their position, special opportunities not shared by the others, to become informed of the volume of trade, not only in different sections of the country, but of each particular dealer, and of the volume of business of each particular manufacturer, enabling them, from a superior knowledge of the requirements of the various sections, and the product of the several manufacturers, to make earlier and more reliable estimates of the probable course of trade than the other members of the organization can hope to do.

After stating other important objections, reference is then made to the example which manufacturers, who do not like to see unions formed among their men for the purpose of influencing the volume or price of the product which the workmen have to sell, viz.: their labor, set to their men, by themselves entering a combination of manufacturers formed to influence in similar ways the volume and price of what they have to sell, viz., their goods.

The Size of the Apple Barrel.

One of the burning non-political questions of the day (political questions being, of course, always burning questions) in western New York, is the size of the apple barrel. Like the weight of a ton of coal or the size of the traditional piece of chalk, the package in which the esculent apple is carried to market has always given trouble. In fact, the apple itself has made more or less trouble for mankind since the days of Mother Eve. Now, however, the vexed question is likely to be soon settled, and we shall know whether the standard apple barrel is to bear any relation to the barrel ordinarily used to contain the resulting juice of that fruit, or whether it is to sympathize in size with the beer barrel, the pork barrel, the flour barrel, or the barrel of money which we see so often referred to in the political papers. At any rate, we shall all hereafter munch the ponderous pippin or rubicund rambo with more satisfaction when assured that it was conveyed to market in a barrel of orthodox dimensions.

Mechanical Refrigeration.

For several months vigorous agitation has been kept up by the butchers of New York against the transportation of dead meat from the West and South in refrigerator cars. As a part of this opposition to dressed meat brought from a distance, the assertion is frequently made that the process of refrigeration is carried out by chemical means, which deteriorate the meat and introduce ingredients that prove injurious to health. So successfully has this crusade against dressed meat been carried on that the Central Labor Union was induced to pass resolutions condemning the practice of bringing meat to New York that had been subjected to the refrigerating process, although no body of citizens are more directly interested than those who compose labor unions in the success of any process that tends to reduce the famine prices that New York butchers habitually put upon the articles of food they supply to the public. As much profound ignorance prevails regarding how refrigeration of meat is carried on, we propose giving a brief description of the process followed.

At the foot of Sixtieth Street, near the Hudson River, New York City, there is a large, oblong brick building, covering a whole block, where slaughtering and refrigerating meat are extensively carried on by T. C. Eastman. The system of refrigeration followed here may be accepted as representative of mechanical refrigeration. Although other establishments pursue methods that differ in details, the difference is not material, since the same end is accomplished.

We shall not pause to describe the excellent mechanical arrangements carried out in the Eastman place for killing the cattle, cleaning, skinning and transporting them to the refrigerating rooms. Suffice it, that they can kill 500 head of cattle in ten hours, and the greater part of the handling is done by specially-designed hydraulic machinery. The sanitary arrangements seem perfect, and nothing is wasted. The carcasses, while still warm, are hung in refrigerating rooms, where they remain hanging for several days till they become frozen solid. Two refrigerating machines, placed in another building, produce the low temperature which freezes this dead meat. The machines are of the De La Vergne type.

Each machine consists of two compressors, 18x36 inches, driven by a Harris-Corliss engine, 32x36 inches. These machines, combined, are capable of producing refrigeration equal to the melting of 220 tons of ice every twenty-four hours. Ammonia gas is used to produce refrigeration, but the operation is entirely mechanical, and the gas has no more to do with the meat operated upon than the steam that runs a flour mill has to do with the flour turned out. The same may be said for ether gas, which is used in some refrigerating operations, and, along with ammonia, is made a bugbear by the enemies of dressed meat. The compressor takes in anhydrous ammonia, and compresses the gas to a tension of 160 pounds to the square inch, which liquifies the gas. This liquid is forced, while under compression, through a coil of pipes, over which cold water continually runs, which abstracts the heat due to compressing. The liquid, thus cooled, is now wire drawn, and permitted to expand through pipes coiled round the freezing rooms. The gas, previously in a small volume, was robbed of its heat, and now, when it is expanded into a large space, the gas becomes intensely cold, and the pipes assume a temperature about the same as the gas inside. By this means the cold pipes reduce the temperature of the air in the room to whatever point is needed for the process of refrigeration. As the gas gets warmed in keeping down the temperature of its surroundings, it is drawn off, to be again compressed, and a newly-cooled supply passed into the pipes; so the cycle of refrigerating work is kept going.

Part of these refrigerating works is cooled by a brine mixture which keeps liquid below the freezing point, and is run through the pipes in the freezing rooms. This brine is kept cool by passing over pipes containing the expanded ammonia. In other cases a current of air is passed over the pipes containing the freezing medium, and from thence injected into the rooms. Although ammonia is a peculiarly odorous gas, no smell of it can be detected about the freezing rooms, so it is impossible that it can impregnate the meat.

In the Western States, where establishments of this kind are located for killing cattle direct from the pastures, the meat is kept till it is ready for transportation, when it is shipped in refrigerator cars that are kept cold by a supply of ice. The flesh of animals killed fresh from the pasture and preserved by this process, must be more wholesome food than the flesh of animals that have been tortured through many hundreds of miles journey in a railroad car.

Sand Dryers for Locomotives.

Several weeks ago the chief draftsman of a leading railroad, who was in New York on business connected with the equipment of new shops with the necessary machinery, called at this office, and during conversation mentioned that he had seen no good apparatus for drying the sand needed for locomotives. At his suggestion we put a note in the paper, asking anyone who knew by experience of a satisfactory arrangement for drying sand to furnish particulars for the the benefit of others. In answer to this request we have received quite a number of communications about sand dryers, but most of them related to stoves or furnaces where the sand is dried on hot plates. We have endured quite extensive experience with sand dryers of this description, and we do not think any of them fill what is a felt want. A furnace with hot plates for sand drying is a most expensive and troublesome way of getting the work done. We have tried the best stove arrangements—or, at least, those that have been most industriously advertised as perfect—and we found them but little better than the furnace. The ordinary sand drying furnaces and stoves in use are made to dry sand, but we do not know of any industrial operation where so much coal is consumed for such a small return in usefulness.

In another column Mr. Crowley describes an appliance which he put up for drying sand, which we consider to be a step in the right direction, and which is worthy of the attention of those interested in this subject. The device consists of an arrangement of steam pipes, which dry the sand and permit it to drop away from contact so soon as the moisture is extracted. If we mistake not, a similar device is in use at the Chicago, Burlington and Quincy Railroad shops at Aurora, Ill., and gives perfect satisfaction. We think it would pay a manufacturer to put a dryer of this kind upon the market. An arrangement of pipes could be made and provided with the means of returning the condensed water back to the boiler, by that means saving fuel. We are certain that no railroad company could afford to be without a sand dryer of this kind, if it were got out at a moderate expense. Meanwhile, we commend the description of the pipe sand dryer to the attention of master mechanics.

American Water-Works Association.

In last week's issue we referred briefly to the report of this association, closing our reference with a suggestion of the advisability of the association paying attention to the tests of water-works machinery. Since then we have received a communication from the secretary, J. G. Briggs, of Terre Haute, Ind., inclosing a blank, from which we extract the following:

To the Members of the American Water-Works Association and others interested in Steam Coals.

GENTLEMEN: The arduous duty of ascertaining the relative value of all the different kinds of coal in use throughout the country (in connection with a proposed system of keeping records and making annual reports) was assigned to a committee at our last convention. In order to compile a statement that will be

accurate and reliable (and which will be of much value, not only to the association, but to manufacturers and users of steam machinery), it is requisite that we have the hearty co-operation of all interested, and the results of any previous tests, either positive or comparative, with as much data as possible, are earnestly solicited. All waterworks managers are especially requested to make what tests of the kind they can, and forward the same to either member of the committee before March 1st, 1885, as per accompanying blank. You will please bear in mind that as the report of this committee (if satisfactory) will be adopted by the association, and declared the official standard for all future duty tests, it is necessary it should be as full, accurate and reliable as possible.

Additional blanks will be furnished upon application to either member of the committee.

Very respectfully,
J. G. BRIGGS,
Chairman of Committee.

As Mr. Briggs suggests, if sufficient statistics can be obtained, the matter will be of general value to manufacturers and users of steam machinery, giving them approximate knowledge of the comparative thermal value of coal in various localities, and an idea of the best kind of boilers and boiler setting for these localities. The blanks referred to cover all ordinary dimensions, as well as manner of supplying water to boiler, and the data necessary to form conclusions from boiler tests. We hope the members of the association will take such an interest in the matter as will make these tests the most valuable of the kind yet furnished.

Having heard reports of the serious illness of Mr. Alexander Gordon, general manager of the Niles Tool Works, Hamilton, O., and having had inquiries in reference to same, we made inquiry as to the truth of these reports. Mr. McKinney, secretary of the works, informs us that the reports are very much exaggerated. He writes us: "Mr. Gordon is not at all well, and is now seeking much-needed rest in Europe, hoping fully to regain his health. For several years he has closely applied himself to his business, and requires the rest and relaxation he is now taking. He has been at Carlsbad, and is now at Creiff, Scotland. He expects to return in October, and will then, no doubt, once more make a full hand at the business."

In Letters from Practical Men, this week, Prof. Sweet continues the subject of proportioning slide valves. The matter is put by him in an extremely simple form, and we recommend these articles to all who are interested in the subject. With practical men the graphic method employed will always be popular, and, all things considered, mistakes are less likely to occur in the use of this method than in mathematical demonstration.

We would call attention to the fact, that the subscription price of *Descriptive America*, the new geographical and industrial magazine, recently started by George H. Adams & Son, 59 Beekman street, New York, and noticed by us some time since, has been changed, since the first number was issued, to $5.00 a year. The price per single copy, 50 cents, remains unchanged.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published

(331) S. M., Philadelphia, Pa., asks: In the article by John E. Sweet, on proportioning valves, in the AMERICAN MACHINIST of August 16, he says strike a circle equal to the travel of the valve. Does he mean that the diameter of circle or its radius shall be equal to the travel of valve? *A.*—Its diameter.

(332) J. W. E., Chillicothe, O., asks: What is the best mixture for a locomotive bell, and what is the usual weight? *A.*—The usual weight is from 80 to 90 pounds. A common mixture is 4 parts of copper to 1 part of tin, to which is added 17 oz. antimony, 4 oz. zinc, and, in some instances, two parts of lead.

(333) W. S. B., Baltimore, Md., asks: Will you please give me your opinion of the horse-power of an engine of the following dimensions, and under the following conditions: Cylinder 12″x20, revolutions 100, steam pressure 80 lbs, steam pipe 3″ diameter, 20 ft. long with two elbows, exhaust pipe 3½″, one elbow, slide valve cutting off at ¾ stroke? I mean the maximum horse-power. *A.*—With well-proportioned valve and valve motion, probably about 75-horse power.

(334) W. S. H., Morgantown, W. Va., writes: I am building an engine 5″x7″, to run 250 revolutions. I want to ask: 1. The steam ports are 2″x1⅛″, exhaust port 2″x3¼″. Are they proportioned right? *A.*—We should much prefer steam ports 4″x⅜″, exhaust port 4″x¾″ 2. What should be the size of steam and exhaust pipe? *A.* If short and direct, steam pipe 1¼″, exhaust pipe 1½″ will answer. 3. What will be the horse-power of such an engine with 60 lbs. boiler pressure? *A.*—About six-horse power.

(335) Inquirer, Benwood, W. Va., asks: Can you inform me of any method by which I can learn telegraphy without going into an office? I am engaged in a store, and during dull days would like to put in my time in learning something. *A.*—We know of only two ways of learning telegraphy. One—and the best—is in an office, and the other by attending a school where telegraphy is taught. If you have your evenings to yourself, perhaps you might make arrangements for instruction by the operator in the office in the place in which you live.

(336) R. S., Providence, R. I., asks: 1. What is the horse-power of a vertical boiler of the following dimensions: Diameter 72″, height 14 feet, diameter of fire-box 5½ feet, height of fire-box 4 feet, number of tubes 155, diameter of tubes 2″, length of tubes 10 feet? I make the horse-power 85 or 90 *A.*—We make the heating surface of this boiler, approximately, 820 feet. Barr, in his work on steam boilers, makes 12 feet heating surface equal a horse-power in vertical boilers. From this rating the boiler would be 68-horse power. This rating is, however, for an ordinary engine. With some of the best engines, undoubtedly the boiler could be worked to or beyond 100-horse power. 2. What would be a safe working pressure for such a boiler, the shell being ⅜″ best flange iron, tensile strength 50,000 lbs.? *A.*—According to the authority previously quoted, the safe working pressure of a single-riveted shell 72″ diameter, ⅜″ iron, tensile strength 50,000 lbs. is 87 lbs. This allows a factor of safety of 6. For double-riveted shell 104 lbs., 20 per cent. being added for double riveting

(337) R. C., Hamilton, Ont., writes: I am building a portable engine, 7″x10″. to run 200 to 240 revolutions. 1. What should be the size of admission and exhaust ports, what the width of bridges, what lap should the valve have, what lead, what should be the width of exhaust cavity in valve? *A.*—Very good proportions would be: Steam ports 6″x⅝″, exhaust port 6″x1¼″, bridges ⅝″ steam lap 9-16″ exhaust lap ¼″, lead 1-32″, travel of valve 2¼″. These proportions will fix the other dimensions asked about. 2. What should be the dimensions of steam chest? *A.*—Make steam chest sufficiently large to take the valve, and provide for the travel without danger of striking, and to provide room for steam to get to each port without being obstructed. 3. What thickness should the piston-head be, and what the size of rings? *A.*—Piston 3″ deep will answer very well. You will have to determine for yourself what kind of piston packing to use. For small pistons a very common packing is cast-iron rings, about ⅜″ wide and ¼″ thick, turned about ⅛″ larger than piston. A piece is cut out of the rings and they are sprung over the piston and into grooves turned in the latter. 3, What would be the horse-power of the engine with 80 lbs steam? *A.*—At 240 revolutions, from 12 to 15-horse power.

(338) O. S., Knoxville, Tenn., asks: 1. We have a countershaft running 90 revolutions, driven by miter gears 12″ diameter. Can we take off one of these gears and put on another, so as to run the countershaft 100 revolutions? *A.*—No; you will have to change both wheels. 2. My engine has a riding cut-off. At what point in the stroke shall I cut off to get best results? The engine is 12″x24″, running 120 revolutions. *A.*—With steam pressure from 60 to 80 lbs., cut-off at ¼ stroke, if you can do the work there. 3.—Is it injurious to a boiler to feed at the top instead of the bottom of boiler? *A.*—In many instances boilers are fed only a little below the water surface, and by many engineers this is believed to be the best place for the feed. 4. Will steam running through the cylinder of a steam engine in cold weather, that is, with the throttle-valve just a trifle open at night, cut the rings? Would it be best to put a stop-valve close to the boiler? *A.*—It is best to have a stop-valve at boiler. A little steam let through the cylinder may not cut the rings, but will be liable to corrode some of the parts. We should not let any steam through the cylinder at night, unless it was absolutely necessary to keep from freezing. If your stop-valve at boiler is quite tight there will be no water in the cylinder to freeze. A small drip-valve in the steam pipe, between the stop-valve at boiler and the throttle-valve, may sometimes be put in so that left open it will drain out any water that passes the stop-valve. You must use your judgment in the matter, the point being either to keep water out of the cylinder, which is the proper plan, or failing to do this, keep the cylinder so warm that it will not freeze.

BUSINESS SPECIALS.

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Curtis pressure regulator and st'm trap. Aug.23, p.14.

Mackenzie Cupolas and Blowers. 245 Broadway, N.Y.

Presses & Dies, Ferracute Mach. Co., Bridgeton, N. J.

Steel Name Stamps, &c J. B. Roney, Lynn, Mass.

Rotary Files, Tower M. Works, E. Brookfield, Mass.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 86 John street, N. Y.

Crists' high-speed compound engines. Crist Engine Works, 182 Centre st., N. Y. Send for circular.

Herbert W. T. Jenner, Mechanical Engineer and Solicitor of Patents, 632 F st., Washington, D. C.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill

The latest Improved Tack and Match Machinery is made by White Machine Co., Waterbury, Conn.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

Universal grinders for lathe-centers, chucks, angles, or cylinders. C. C. Hill, 84 Market st., Chicago Ill,

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders

National and box chucks, foot and power lathes, and slide rests. Lodge, Barker & Co., Cincinnati, O.

DRAWINGS—Mechanical, electrical and Patent Office. All styles of artistic designing. Special facilities. Low rates. Wallace Metcalf, 140 Nassau St., N.Y.

Guild & Garrison's Steam Pump Works, Brooklyn, N Y. Steam Pumping Machinery of every description. Send for catalogue.

Improved Tack Machinery, made by The Willets Man'f'g Co., can be seen in operation at their works, 57 Clifford St., Providence, R. I.

The "Wax Process" Engravings shown in the AMERICAN MACHINIST each week are made by Struthers, Servoss & Co., 32 Frankfort Street, N. Y.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large: prices low. Frasse & Co., 62 Chatham St., N. Y.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant, $2.50; Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

Steam users, expecting to put in a first-class engine, from 10 to 60-horse power, will find it to their interest to send to the Straight-Line Engine Company, Syracuse, N. Y., for their new catalogue.

EXTRACTS FROM CHORDAL'S LETTERS, 400 pages, 12mo., handsomely bound in cloth. New and enlarged edition, with over 50 illustrations. Price $2. Published by John Wiley & Sons, 15 Astor place, New York.

MANUFACTURES.

A machine shop is to be erected at Reynoldsville, Pa., by Charles Harpel, of Pittsburgh.

The shops of the new Chesapeake and Nashville Railroad will, it is stated, be located at Nashville, Tenn.

The Catawba Oil Mill, at Chester, S. C., is to be enlarged for the purpose of placing more machinery.

John J. Brierly is building a two-story brick workshop on Second avenue, near 64th street, New York.

Tobin, Hambler & Co. are making a $3,000 addition to their foundry building, at 869 Halsted street, Chicago, Ill.

Holmes & Robbins, Gardiner, Me., have engaged in the manufacture of steam boilers—a new industry in that town.

The estate of D. K. Decker is erecting, at 20 and 22 Bergen street, Brooklyn, N. Y, a four-story brick manufactory, to cost $8,400.

J. N. Patterson is contractor for erection of a three-story factory, 30 by 32 feet, on Point street near Gunn avenue, Philadelphia.

The New York Central Railroad Company is building a one-story brick blacksmith shop, 25 by 40 feet, in the rear of the Grand Central depot, New York.

The Eldridge Sewing Machine Company, Chicopee, Mass., after a suspension of fourteen or fifteen weeks, has started up its works and is considerably behind its orders.

Leopold Kaufman, 129 East 30th street, New York, is building a six-story brick factory, 47 by 125 feet, on First avenue, corner 33d street, New York, to cost $70,000.

H. B. Scholes, 111 Bedford avenue, Brooklyn, N. Y., is erecting a two-story brick factory on Hewes street, near Broadway, that city, 64x64 feet, to cost $6,000.

James Beggs & Co., 9 Dey street, have taken the New York City agency for the Valley Machine Company's direct-acting steam pump, and are having a good trade in them.

Charles Schildwachter will shortly commence the erection of a four-story carriage and wagon factory, on 125th street, near Lexington avenue, New York, to cost about $15,000.

The Tricycle Manufacturing Company, Springfield, O, are completing a three-story addition to their works, 150x48 feet. They will place new machinery in the part added.

The Bethlehem (Pa.) Iron Company, which recently made a reduction of twenty per cent. in wages, has followed it by a like reduction in the rent of tenement houses to its employes.

R. J. Steel, Petersburg, Va., writes us: Work in the iron business, at this time, down here, is very dull, and if there is not a change somewhere, I don't know what will become of the mechanics.

The Co-operative Foundry and Stove Works have been incorporated in West Virginia, by August Kirke, J. S. Godfrey, Thomas Kirwan, Henry Moetsen and Frederick Schmidt, of Martin's Ferry, O.

The Eureka Screw, Bolt, and Nut Manufacturing Company is the name of a corporation recently chartered at Alexandria, Va., for the purpose of manufacturing threaded bolts, under the Cochrane patents, by rolling the screw threads on the bolts while the blanks are red hot.

Walter Scott & Co., Plainfield, N. J., write us: Our buildings are nearly finished. We are at present placing boilers, engine bed, and tool foundation; shafting will be in place in two weeks, and we expect to apply power and start pattern making in about one month. Machine and foundry work will not begin for, say, three months.

The pair of Davidson pumping engines put in about two months ago, at the village of Catskill, N.Y, are pumping 25 per cent. in excess of the guaranteed capacity, obtaining an economic duty of 69,000,000 lbs. feet. Pending the completion of the reservoir, the engines have been pumping direct into the mains, at a pressure varying from 115 to 130 lbs. at pump.

The Almond Angular Coupling, illustrated in the AMERICAN MACHINIST, November 24, 1883, is meeting with very good success in this country. The inventor, Thomas R. Almond, 84 Pearl street, Brooklyn, N. Y., has just completed arrangements with a prominent English firm, Cayley & Cayley, of London, by which they will at once proceed to manufacture the coupling, and place it on the British market.

It seems manufacturing companies are beginning to take pattern after railroad companies. A meeting of the stockholders of the Harrison Wire Company, of St. Louis, has been called for September 25th, to vote on a proposition to increase the bonded indebtedness of the company from the present amount, $150,000, to $250,000 Of course, in time, we may expect to see manufacturing companies issue three or four varieties of "first mortgage" bonds, second mortgage bonds, and income bonds.

Mr. C. A. Leib, 23 Vandewater street, New York, is building a novel lap-polishing machine of his own invention. It is a flat disk, 25 inches diameter, made of a composition of copper, tin and antimony. The disk is mounted on top of a vertical stem, and it revolves on a horizontal plane. Fine emery is rolled into the surface of the disk, and the soft metal appears to absorb a portion of the emery. The flat revolving surface provides excellent means of polishing fine machine work. Mr. Leib is quite busy with printers' material.

An effort is being made to secure some manufacturing enterprise for Damariscotta, Me. It proposed to raise by subscription among Damariscotta people the sum of $15,000, or thereabouts, with which to build a factory for the manufacture of shoes, the factory to be provided with an engine and boiler, and to be large enough to employ two hundred or more hands. This building will be let to such party or parties as will come into town and run a shoe factory, said parties to pay a rental on the building equal to five per cent. of its cost, and be exempt from taxation for a term of years.—*Mining and Industrial Journal.*

The *Boston Commercial Bulletin* says: New iron works have just been built and opened by Rawson & Morrison, on Main street, Cambridgeport, Mass., just across the West Boston Bridge. Mr. George W. Rawson, formerly of Rawson & Hittinger, has been for the past seven years with Kendall & Roberts as superintendent and designer. The new shop is 125x42 feet, two stories high, and is stocked with twelve lathes, four drills from P. Blaisdell & Co., of Worcester, five planers, punches, presses, and hammer, for the manufacture of stationary, marine, portable hoisting and ship engines, hydraulic presses, stone crushers, shafting, marine boilers, tanks, etc. They will make a specialty of the Rawson patent fertilizer. Mr. George Worthin, who has been with Mr. Rawson for twenty-two years, has been secured as foreman of the machine shop.

Lowe & Watson, proprietors of the Bridgeport Boiler Works, Bridgeport, Conn., report their business improving, they having received a number of unexpected orders, amongst which may be mentioned orders for four Lowe boilers, among them one of 50-horse power for Warner Brothers of that city, to increase the boiler capacity in their largely-increased factory buildings. This is their third order for Lowe boilers since they commenced business there. Their orders include one of 70-horse power for the new factory of the Cowles Hardware Company now building in Bridgeport, and a pair of 100-horse power each for the New York Belting and Packing Company's annex factory at Passaic, N. J., which is their fifth order for Lowe boilers in twelve years. This pair of boilers will be made entirely of Benzon steel plates, and are guaranteed to stand a working pressure of 100 lbs. during their reasonable life. The first two mentioned will be fitted with the improved steam superheating drum, and all four will be fitted with the improved front and furnace. Lowe & Watson commenced to build steel boilers fourteen years ago, long before there was much talk of, or business in, steel boilers, and their success with steel plates has been so satisfactory that they now use them in all boilers they make, for the furnaces, combustion chambers, and bottom plates over the furnaces.

Machinists' Supplies and Iron.

New York, August 14, 1884.

There has been no change in the condition of the supply trade worthy of notice since our last report was made The same applies to steam supplies.

Iron—A strong effort is being made to close down furnaces for a few weeks, to make a scarcity of pig iron and thereby bull prices. For months there has been really no overproduction, but merely a supply enough to meet the demand. The attempt at restriction is not to stop overproduction, but to make an artificial scarcity. So many conflicting interests come into action before an agreement can be reached, in a matter of this kind, that it is very doubtful if the stoppage will be tried. Prices of pig remain steady. No. 1 X Foundry is quoted at $19 to $19.50, but slightly higher prices have been got for select brands. No. 2 X is held at $18 to $19; Grey Forge, $16 to $17; with sales slow.

Copper—Ingot is unchanged, and no improvement in the demand Small sales of Lake are reported at 14c., other brands 13c. to 13½c.

Lead—The demand for common pig continues light. A few sales have been made at 3.60c.

WANTED

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Wanted—First-class mechanic, on fine, light machinery. Joseph Boyer, St. Louis, Mo.

Wanted—Permanent situation, by a mechanical draughtsman. Reference given. Address "Square," care Am. Machinist.

Any railroad or locomotive shop wanting an experienced machinist as foreman, can find one by addressing "S. W. Machinist," care Am. Machinist.

An experienced mechanical draughtsman, on general, special, and tool work, desires a position. Can furnish references as to ability. Address Box 9, American Machinist.

Situation wanted by capable and experienced mechanical draftsman and machine designer. Over 30 years experience in American and English shops. Salary moderate. Address "Designer," Am. Mach

Wanted—First-class draughtsman, with experience on machine tools and automatic machinery. Give references and wages expected. Address S. W. Powel, care the Pratt & Whitney Company, Hartford, Conn.

Wanted—A first-class foreman, for engine and jobbing shop, fifty miles from Pittsburgh, Pa., employing forty hands, building steam engines and boilers and general jobbing. Address "Foreman Machinist," American Machinist, giving reference, experience, and salary expected.

Small yacht and horizontal engine castings. Send stamp for price-list. J. L. Lucas, Waterbury, Conn.

Wanted—Second-hand iron planer, about 30"x30" by 8 feet, in first-class condition. State maker's name. Address Am. Machine Works, Detroit, Mich.

For Sale—One Worthington Steam pump, nearly new, in perfect order; size 4½x2¾x4, No. 13,349. Will be sold low if applied for soon. Address Wm. H. Clapp, Weymouth, Mass.

Wanted—One live agent in every machine shop, to sell Brown's patent shrinkage and internal gauge; a new and useful tool for machinists. Address Barbour Brothers, Tarentum, Pa.

Wanted—Parties traveling and selling to steam users, or dealing in mill supplies, to take the agency of a good and fast-selling article. Good inducements offered. Address "Manufacturer," care of Am. Machinist.

TABLES OF SPEEDS.

Tables of the principal speeds occurring in mechanical engineering, expressed in mètres in a second. By P. Keerayeff. Translated by Sergius Kern. Price, 20 cents. Descriptive catalogue of books, 100 pages, free.

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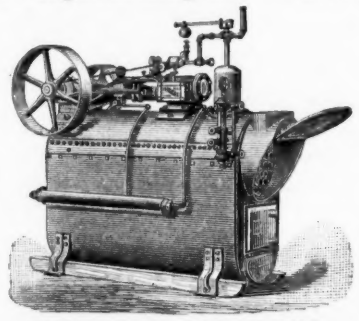

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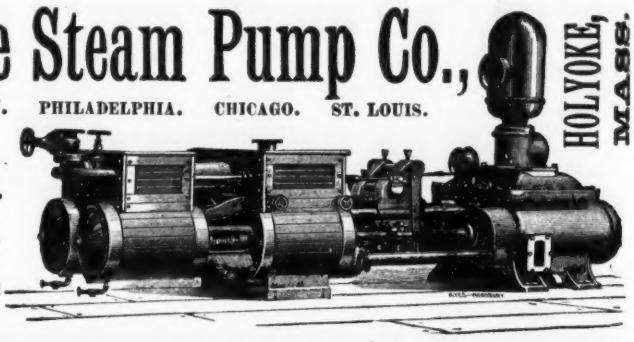
FOR ALL DUTIES.



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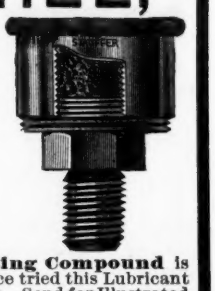

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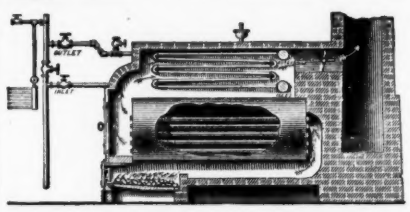

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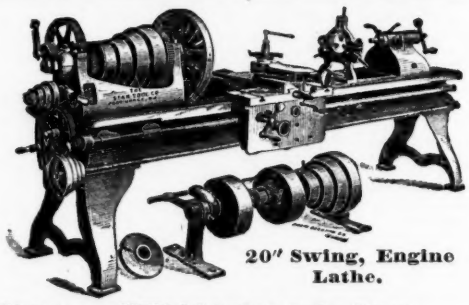

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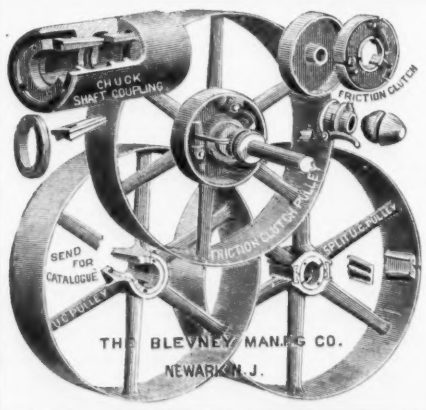
North Attleboro, Mass., June 9, 1884.
T. R. ALMOND, 84 Pearl St., Brooklyn, N. Y.:
Dear Sir—The coupling (Almond's Angular) is working A 1. We have had no trouble whatever, not even so much as to lace the belt; the same belt before needed lacing twice a week. Have run every day, since we put the coupling in, 10 to 12 hours. Have given it a good trial, and cannot see where it is the slightest worn.
W. H. WARD.



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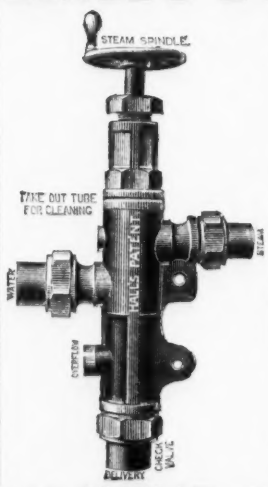

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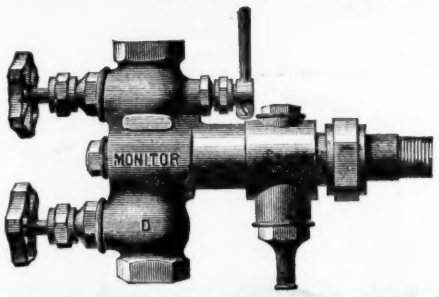

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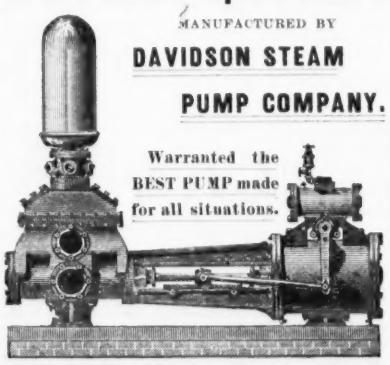

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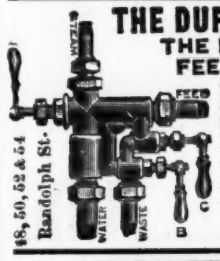

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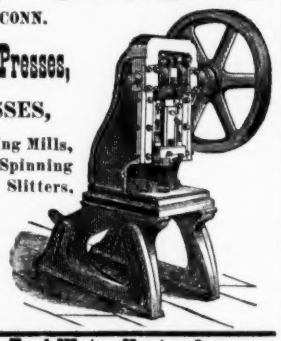

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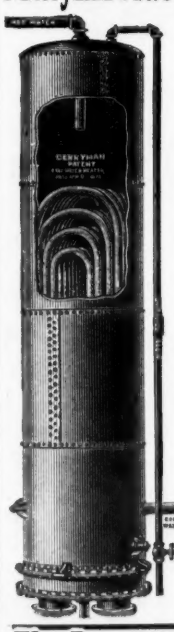

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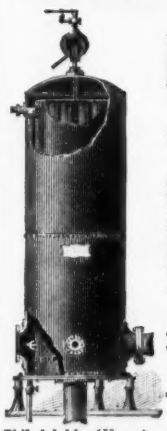

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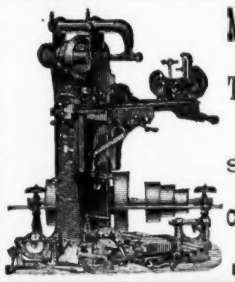

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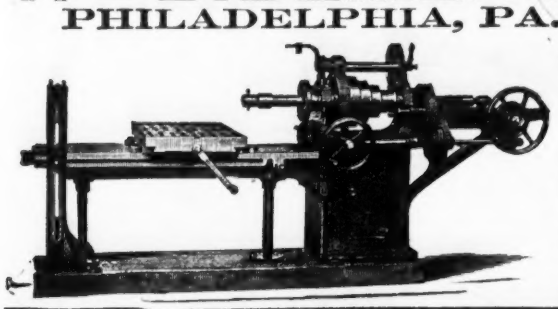

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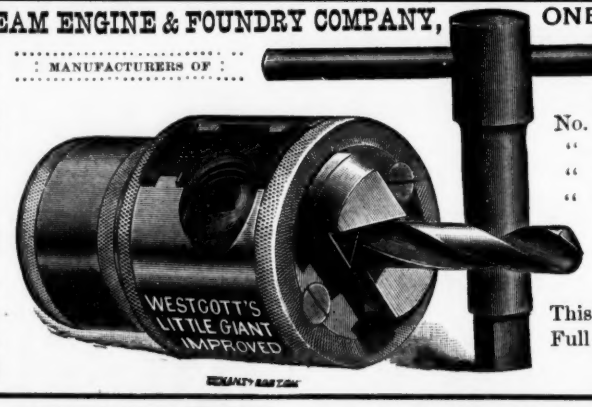

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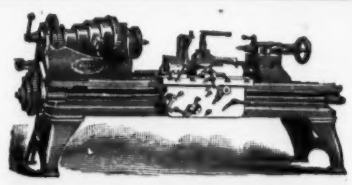

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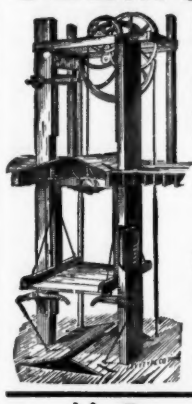

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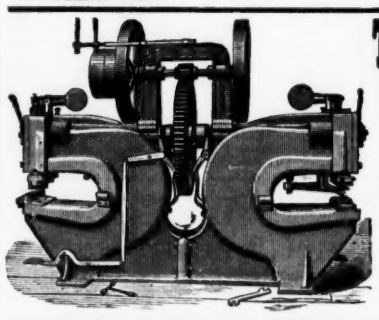

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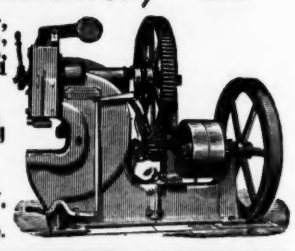

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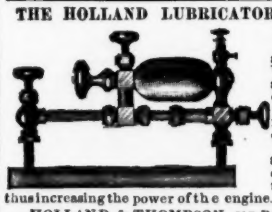

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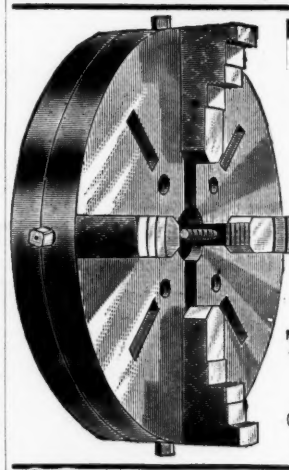

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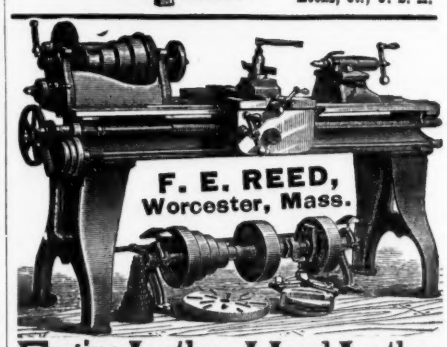

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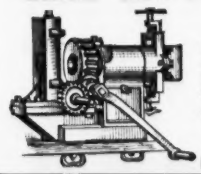

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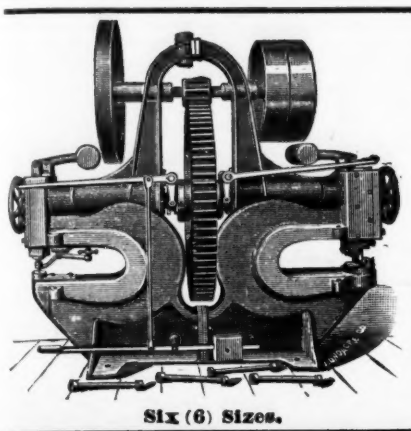

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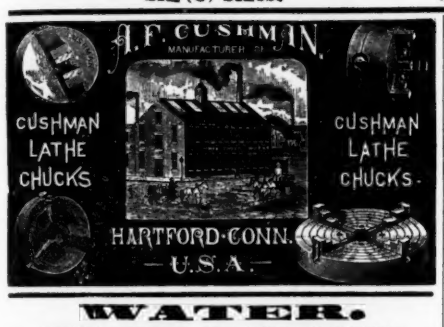

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Office of CRESCENT MILLS,
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MR. JOHN MAYHER, Treasurer,
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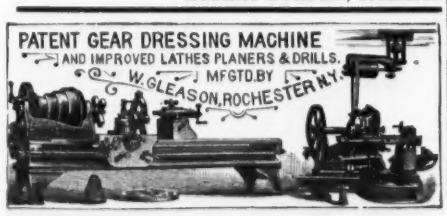
Yours truly,
ROBERT BORDEN, Treasurer.



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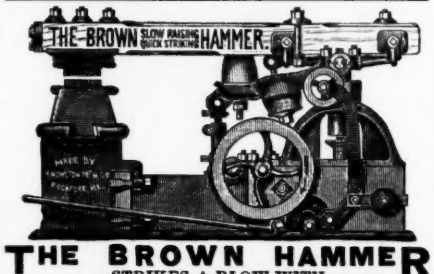

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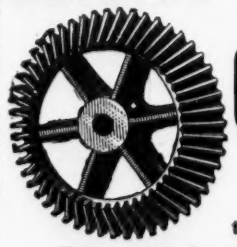

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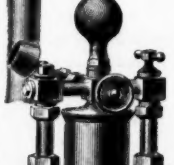

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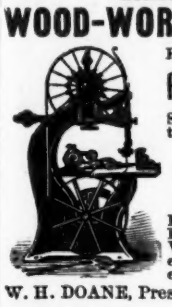

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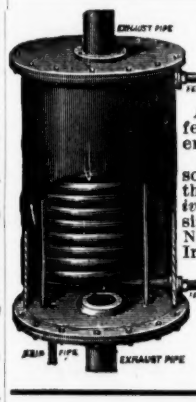

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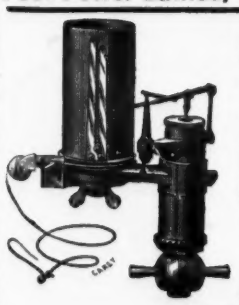

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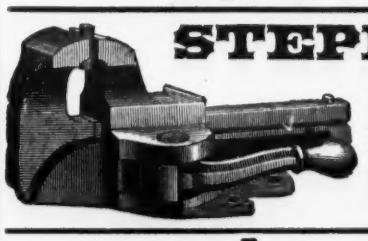

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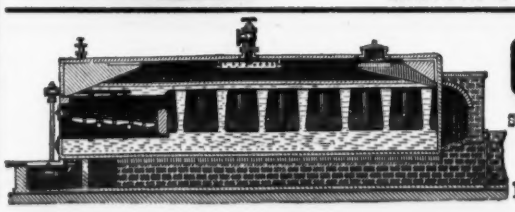

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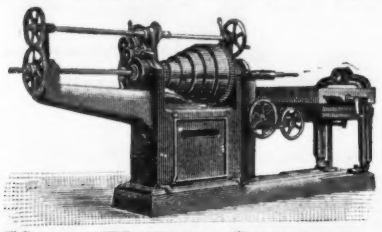

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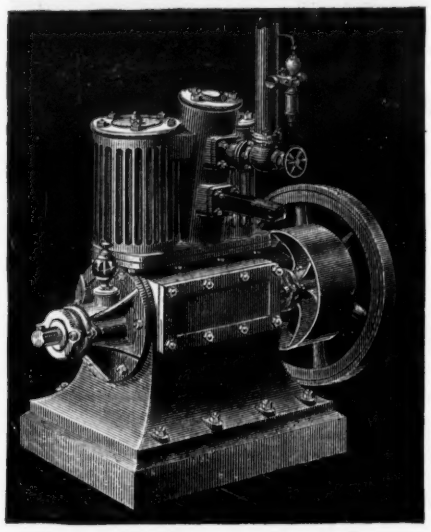

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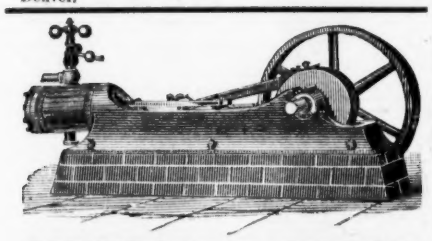

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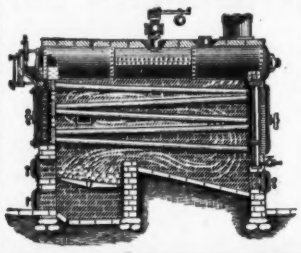

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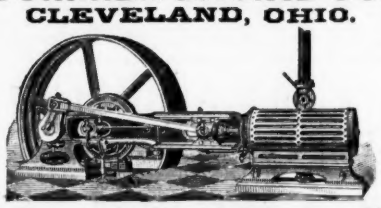

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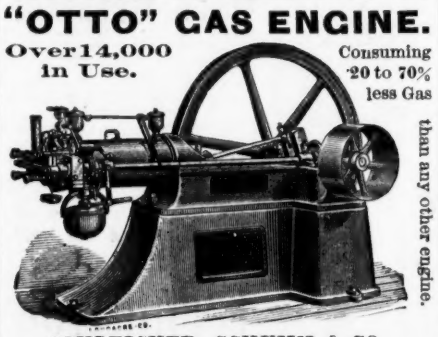

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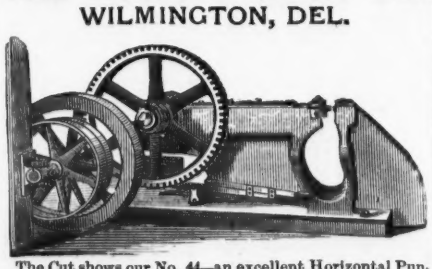

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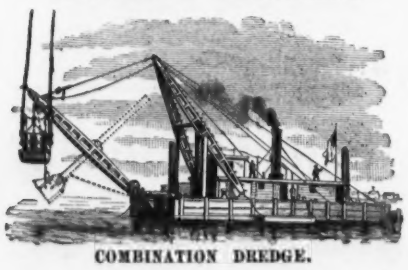

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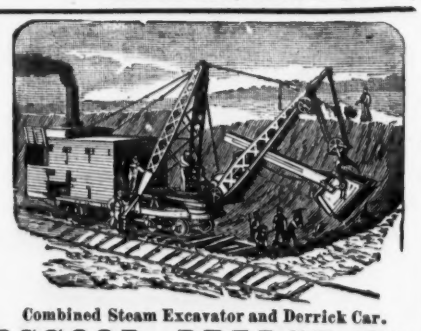

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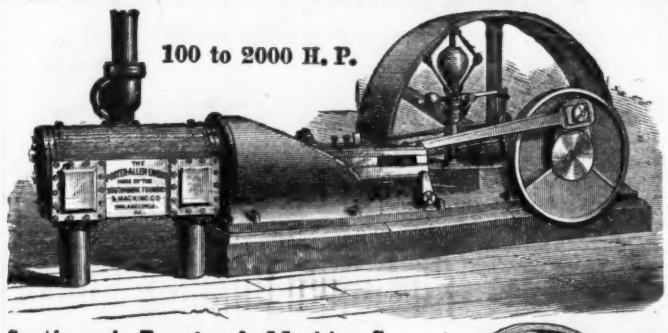

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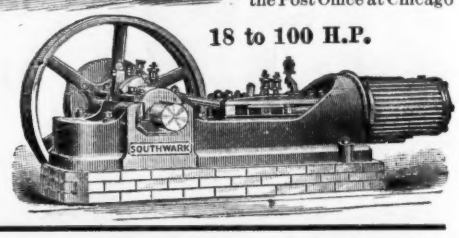

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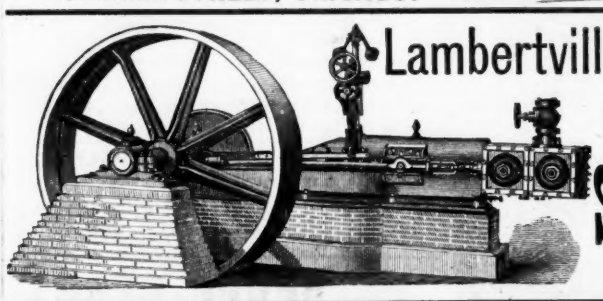

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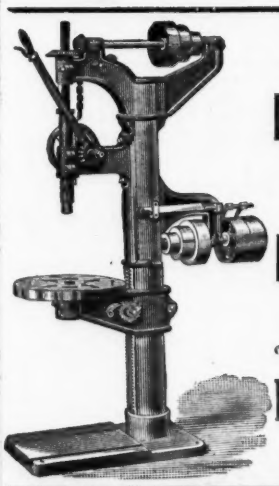

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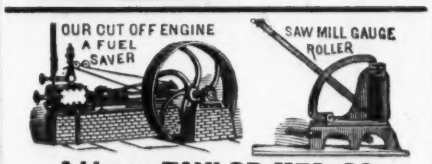

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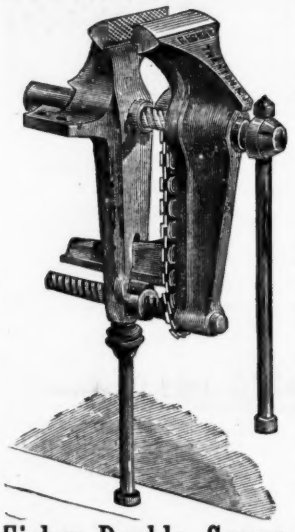

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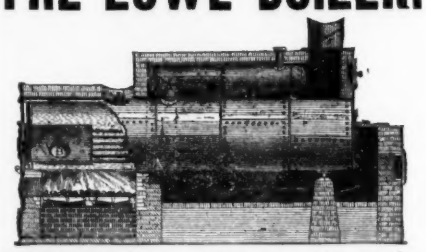

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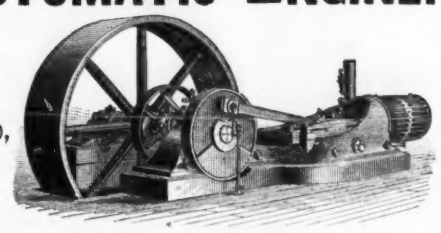

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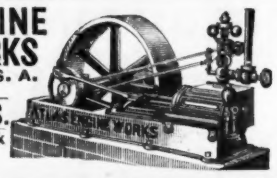

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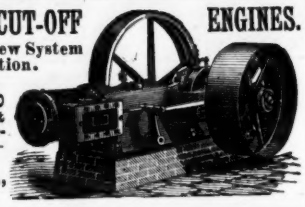

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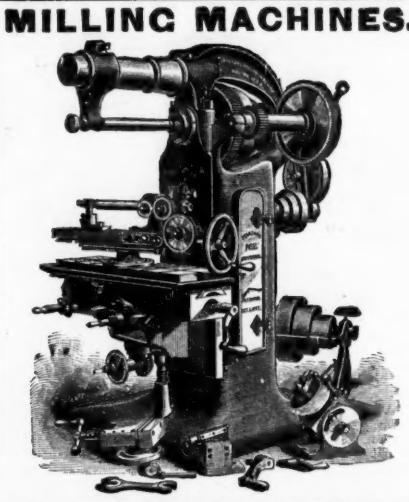

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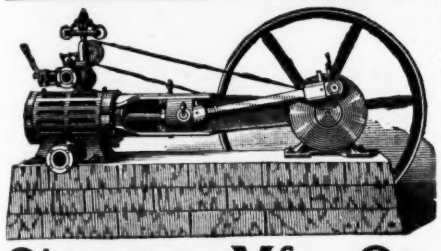

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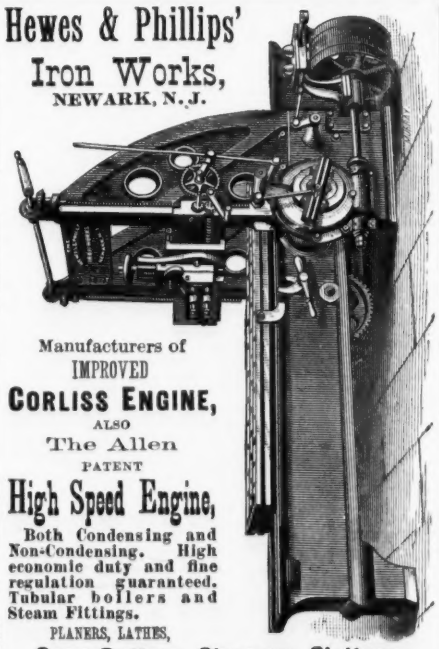

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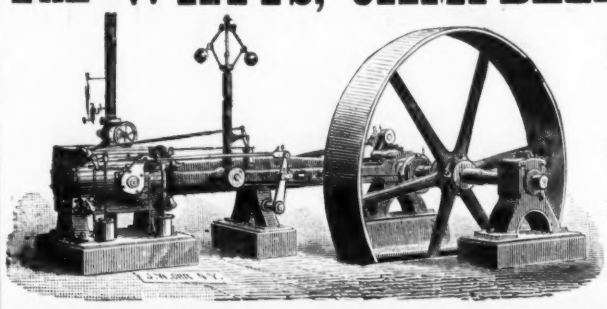

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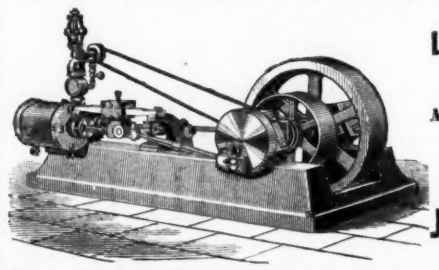

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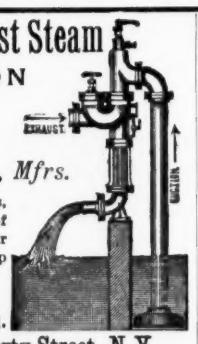

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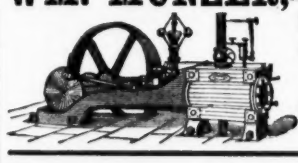

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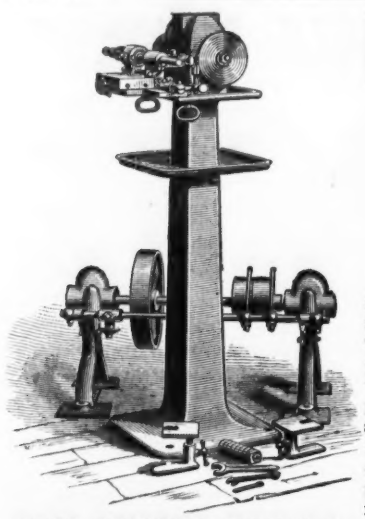

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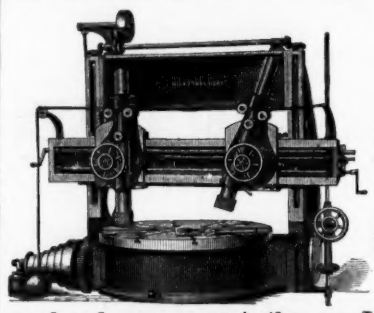

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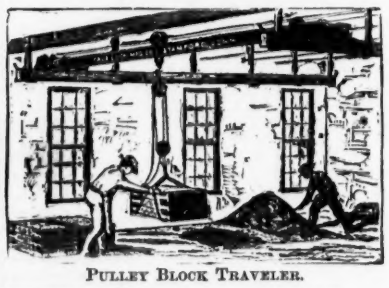

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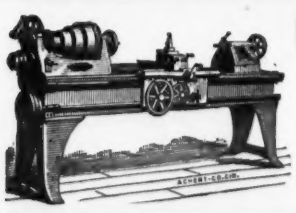

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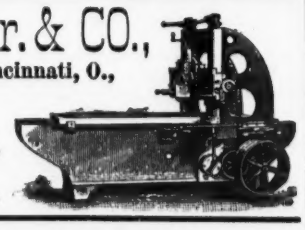

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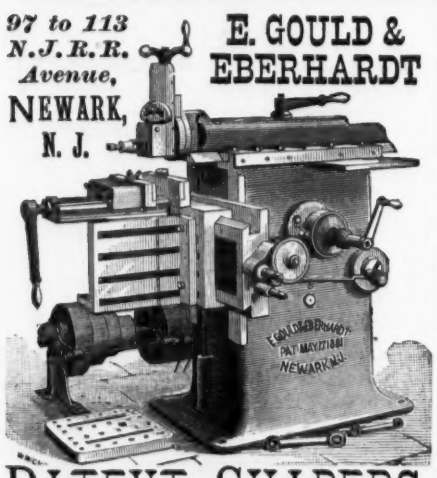

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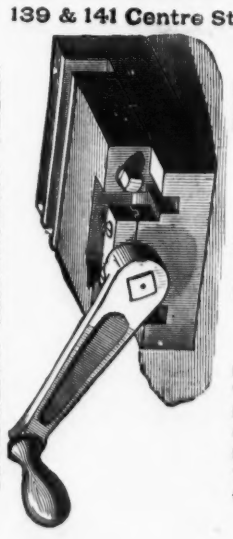

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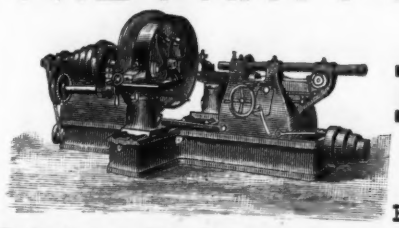

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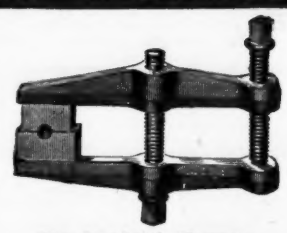

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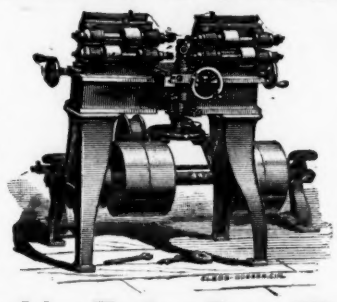

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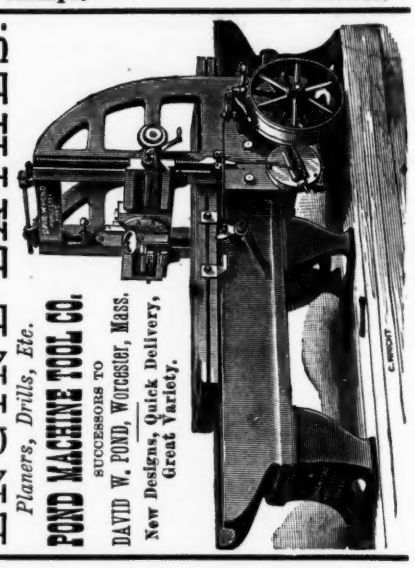

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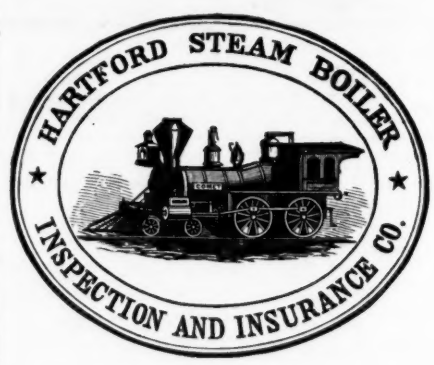

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SECOND-HAND.

Engine Lathes, Screw-Cutting—Three 18 in. Swing, 8 ft. bed, Lodge, Barker; two 16 in. Swing, 6 ft. bed, Ames & Perkins; one 12 in Swing, 5 ft. bed, Read; one 15 in. Swing, 5 ft. bed, B. G. Turret Lathe, Lodge, Barker.

Shapers—One 18 in. Stroke, Prentiss; one 15 in. Stroke, Hendey.

Planers—One 24 in. x 24 in. x 6 ft., Hendey; one 22 in. x 22 in. x 5 ft., Powell.

LODGE, BARKER & CO.

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